MARINE SCIENCE TRAINING PROGRAM FOR ALASKA NATIVE STUDENTS

FINAL TECHNICAL REPORT

USN/ONR N00014-91-J-1266
For Grant Ending January 31, 1993

KUSKOKWIM CAMPUS
COLLEGE OF RURAL ALASKA
UNIVERSITY OF ALASKA FAIRBANKS

by

John Kelley
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January 1994

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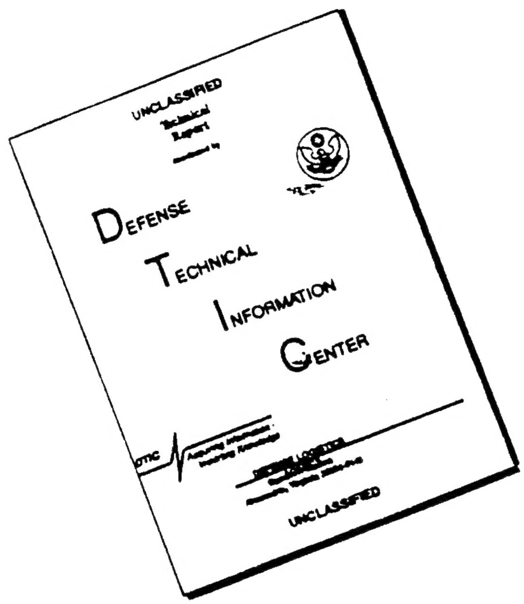

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PROJECT SUMMARY

The purpose of the Marine Science Training for Alaska Native Students was to involve Alaskan Native students in scientific activities in order to encourage them to enhance their understanding of science, to increase their retention and success at the University of Alaska Fairbanks, and to encourage at least some of them to pursue scientific careers. A very small proportion of the Native students at the University of Alaska Fairbanks have scientific majors at present. Marine science can serve as an attractive way to introduce science to these students because it involves multiple disciplines and allows a broad understanding of the interrelationships among the various scientific fields, and also because the marine environment is very central to the cultural background of many of the students. In the few years since this program was initiated, several of the students have become involved in scientific areas, and others have become Native leaders. The program has made a difference in their future in some cases, and in others it has clearly improved their scientific literacy.

The approach was to involve students in research activities in the laboratory and field in a close relationship with a faculty mentor. In addition, students have the opportunity to work at coastal field stations and facilities, or take part in oceanographic work at sea during the summer months. A summer short course in marine science was provided for the interns at the Kasitsna Bay Laboratory on Kachemak Bay, near Homer, Alaska.

PROJECT DESCRIPTION

Introduction

The Marine Science Training for Alaska Native Students was initiated in 1987 with modest research funding from the Office of Naval Research. At that time, support was provided specifically for involving Native students in ongoing research on the ice-covered waters of the Bering Sea. The rationale was that Native students, especially those from coastal villages, have a deep interest in the marine environment, and furthermore have special knowledge about the seas surrounding their homes. We proposed to use this interest as a way of involving the students and capturing their interest in science. Initially, although we hoped to increase the number of Native Alaskan college graduates with scientific majors, we were also trying to increase the scientific literacy of UAF Alaskan Native students regardless of their ultimate choice of major. After two years, the National Science Foundation joined in supporting the program, and we were able to expand the number of students involved. A mentoring approach was adopted as the primary focus of the program, although, as will be described below in connection with previous work done under ONR support, other elements were added to the design. The basic premise that the marine sciences can serve to capture the interest of Alaskan Native students, and help them become comfortable in working and studying in scientific areas, remains central. It must be emphasized that any program which helps to motivate students to complete their degrees is a success, even though the quantitative manifestation of such success may be limited for some time. This is so because Native students have experienced difficulty in adapting to the collegiate life, and consequently there has been a serious problem with high dropout rates.

The Alaskan population includes about 20% Natives among a total of 500,000 residents. This Native component includes Athabaskan Indians in the interior of the state, Tlingit and Haida Indians in the southeastern coastal areas, Inuits along the Beaufort, Chukchi and Bering Sea coasts, and Aleuts along the Alaska Peninsula and the Aleutian Chain and on Kodiak Island. Historically, very few Alaskan Natives have pursued careers in scientific fields. This trend continues today. Out of the 1,372 Alaskan Native students enrolled in the University of Alaska Fairbanks during the fall semester of 1992, only 21 were enrolled in the College of Natural Sciences, which houses the biological, physical, and geological sciences. There are a number of reasons for this. In many cases, early preparation in mathematics and science at the KÐ12 level is inadequate in the villages, and this probably plays the major role in deterring students from pursuing scientific degrees. Cultural adaptation to campus life poses another problem, but of course this impacts success in all fields.

There were 1,372 Alaskan Native students in a total student body of 9,226 at the University of Alaska Fairbanks, in the fall of 1992. This amounts to 15% of the student body. A large proportion of these students (984) were enrolled in the College of Rural Alaska, 180 were in the College of Liberal Arts, and only 21 were enrolled in the College of Natural Sciences. The College of Rural Alaska has campuses at a number of distant sites, including the coastal areas of the Bering and Chukchi Seas. It appears, therefore, that many of the Native students have not

left their communities, or have moved to nearby coastal communities where these campuses are located.

The University of Alaska Fairbanks has an excellent program, the Rural Alaska Honors Institute (RAHI), which helps Native students adapt to university life prior to entering as freshmen. There had been no program specifically aimed at enhancing their knowledge of and/or success in scientific studies, until we began this program.

The University of Alaska Fairbanks places a high priority on the encouragement of Alaska Native students to complete their academic careers. The University of Alaska Fairbanks Strategic Plan, UAF 2000, was issued in February 1993, and explicitly includes the goal of becoming the educational center for Alaska Natives. Our program addresses this goal directly. Its purpose is to encourage Alaskan Native students to pursue scientific studies, or at least to increase the understanding of science by Native graduates of the University of Alaska Fairbanks, through experiences in the marine sciences. This contributes to the University of Alaska Fairbanks mission of serving the Alaskan Native community. It is important to recognize that given the dismal track record in graduating Native students, even if the only short-term victory is an increase in the number of students who successfully complete degree programs regardless of the field, the program will have made an important contribution. Our students have done even better than this, however, with some notable successes.

Brief History of the Program

The program was begun by Drs. John Kelley and Vera Alexander in 1989 to encourage more Alaska Native students to consider careers in the sciences. Because many of the problems facing Native communities are environmental in nature, and often involve marine and coastal questions, it made sense to attract Native students into the marine sciences. The program helps ease the transition many students must make between the village and college life by using faculty and staff as mentors, with the assistance of other college support services such as Rural Student Services (RSS), Student Support Services (SSS), and the American Indian Science and Engineering Society (AISES).

AISES is a private, non-profit organization which seeks to significantly increase the number of American Native scientists and engineers in the nation and to develop technologically informed leaders within the Native community. AISES's ultimate goal is to be a catalyst for the advancement of American Natives as they seek to become self-reliant and self-determined members of society. Each year AISES hosts a national conference. This year the major sponsors were Battelle Pacific Northwest Laboratories and Westinghouse Electric Corporation. The conference was held in Spokane, WA, November 11-14, 1993. Each year the Alaska Native Student Intern Program has been able to sponsor travel costs for selected students. The value of the conference continues after attendance when students come back with a renewed sense of purpose and pride. The contacts that the students make at the conference are invaluable and often lea to future jobs and appointments. This support has been extremely helpful in enabling these bright young minds to achieve their dreams.

How well the University of Alaska is serving the Native Alaska population is summarized in Figure 1 and Appendix 1 (Trends in Minority Student Population 1988-1992, and Comparison of FY92 Native and Non-Native Degree Recipients). There has been a steady increase in the number of Native Alaskans receiving undergraduate degrees, but the number of graduate students is still very small. It is one of our goals to enrich the undergraduate years of our participants and to strongly encourage those capable of doing so to pursue graduate degrees. We have one student who participated in our program as an M.S. candidate and is now pursuing a Ph.D.

In 1990, 8.4% of University of Alaska students were Indian or Native, 3.1% were Black, 2.6% were Asian, and 2% were Hispanic. Whites made up 78.5% of the student population and 5.6% were of unknown ethnicity. Nationally in 1990, Indians and Natives accounted for 0.8% of all students. Black students made up 9.2%, Asian students were 4.2%, and 5.7% were Hispanic students. The national white student population was 80.2%, down from 81.1% in 1988. Between 1988 and 1990, minority populations nationwide slightly increased their proportional representation (NCES, Digest of Education Statistics, 1992 and University of Alaska in Review, 1993).

The program at SFOS/IMS has expanded to 22 students in the 1993-94 academic year. The students are participating in a variety of research projects ranging from involvement with the Sea Otter Commission, to working at the University of Alaska Museum. Students are offered an opportunity to participate in a research cruise during the Spring Break, in March, and have attended informal and formal summer marine science courses at Kasistna Bay, a marine field station associated with the University of Alaska. Students write project reports on individual projects and participate in field reports and other scholarly writing activities connected with the experience in the mentor's laboratory. Results of opinion surveys by both faculty and students (Appendix 2) suggest that periodic retreats/seminars be held to provide a forum for more effective communication between all of the participants including students, faculty and staff. We have excellent interaction on an individual student-faculty basis but not among all of the participants in the program. The seminars will provide a point of contact for everyone.

The intern program has evolved from a project with a small number of participants, both faculty and students, to a much larger number of participants interacting throughout the state. Although we have several ways of tracking progress and managing the program, we wish to introduce our interns to more formal aspects of project management. One of our interns (Jason Evans, author of *A Quality Based Paradigm for the Alaska Native Enhancement Program with the University of Alaska Fairbanks*, Appendix 2) showed interest in this aspect of the program and came to the University after involvement in industry. He was familiar with Total Quality Management (TQM) principles which we employ on another federal program (NSF/OPP, Polar Ice Coring Office). On a limited basis, we intend to orient a part of our program toward project management since many Native and minority students enter management level positions in their communities soon after leaving college.

Marine Science and Related Programs at the University of Alaska Fairbanks

The University of Alaska Fairbanks' marine sciences instructional program is primarily a graduate program leading to the M.S. or Ph.D. degree. This program includes training and experience in the disciplines of physics, biology, chemistry, and geology applied to oceanographic topics. There is a very strong tradition in research through the Institute of Marine Science and its companion research institutes, the Geophysical Institute and the Institute of Arctic Biology, as well as the College of Natural Sciences, the College of Rural Alaska, the Institute of Water Resources and the School of Engineering. The Institute of Marine Science operates state-of-the-art laboratories including sophisticated acoustic analysis equipment, mass spectrometers, HPLCs, and Gcs which have been made available to our Native interns through either direct involvement with mentors or the field practica. Furthermore, the West Coast National Undersea Research Center, located within the School of Fisheries and Ocean Sciences, has facilitated the use of leading edge *in situ* technology.

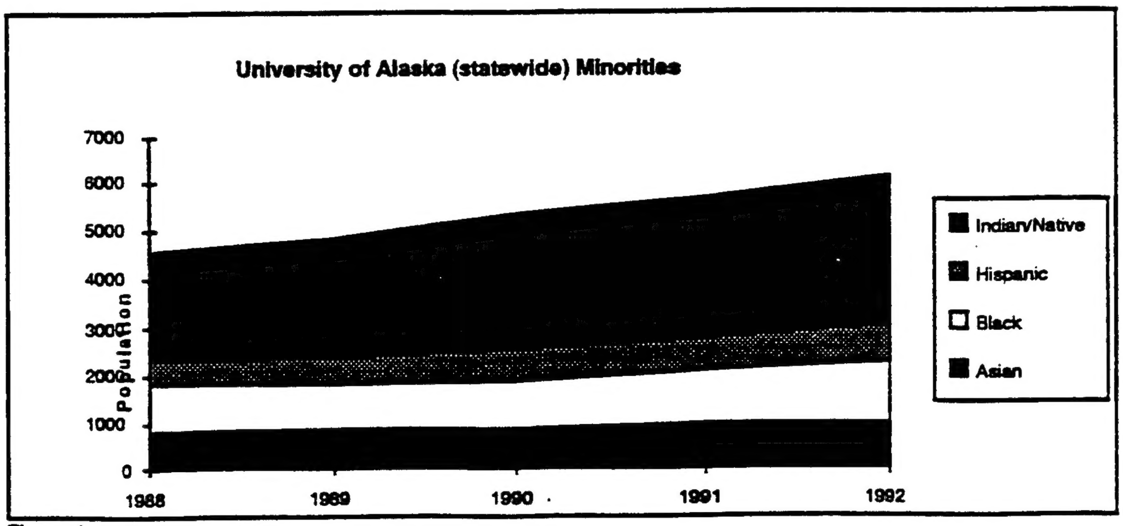


Figure 1.

Summary of Results

In the initial year of this project, Native students were assigned on a one-by-one basis to faculty mentors for the summer months, with the obligation to spend 6 to 8 weeks in intensive work. In addition, a tuition and book allowance was provided for the following academic year. Subsequently, opportunities also were provided for the students to participate in cruises on board the R/V Alpha Helix or to visit field stations. Additional opportunities were used as they became possible, such as participating in the atmospheric monitoring program at Barrow and presenting results at national meetings. The critical element all along, however, has been the one-to-one mentor/student relationship. The support for the students now extends through the academic year as well as the summer months, providing continuity in their developing interest and involvement.

Recruitment of Alaska Native students to this program has been assisted by the College of Rural Alaska as well as the Rural Student Services office on the Fairbanks campus. As students pass through our program, word-of-mouth is becoming an important avenue for students to become aware of the opportunity to participate.

There is a broad range of programs available to accommodate the Native student interns. Students have participated in studies of sea bottom phenomena from submersibles, invertebrate ecological studies of the Bering Sea shelf, studies on the impact of the Exxon Valdez oil spill in Prince William Sound, marine biochemical research, circulation of fjords, seabird studies, arctic oceanography, data processing and management, marine instrumentation, and fisheries oceanography.

Workshops, conferences and other special efforts have been used to enhance student success, especially with respect to writing (required reports), mathematics (field studies and labs) and motivation (special seminars). This year, we established a seminar series held once a month to give all of the students a well-rounded view of marine and terrestrial sciences, as well as to explore issues of interest to the students concerning their communities. For example, the following seminars were presented during the fall of 1994:

September	Radionuclide and other contaminants in arctic seas - J. Kelley
October	Rutting behavior of moose with reference to range degradation - T. Bowyer
November	Organic chemicals in natural surface waters - D. Shaw

In Table 1 we present a summary of the areas of emphasis for students who have been supported by this program in whole or in part.

Table 1. Students in the program, 1993-94 academic year

Student	Research Area	Mentor
Shannon Albright	Marine Mammals	Brendan Kelly
Lina Allen	Marine Geology	Sathy Naidu
	Paleo-oceanography	Bruce Finney
Karl Bergman	Engineering	Kerry Stanford
David Broussard	Fisheries Oceanography	Brenda Norcross
Paul Brown	Marine Invertebrates	Ken Coyle
	Fisheries Oceanography	Al Tyler
La-Ona Dewilde	Biological Remote Sensing	David Eslinger
Alex Dugaqua	Marine Science	Laura Bender
Jason Evans	Marine Science	John Kelley
Terry Fitka	Neurophysiology	Kelly Drew
	Marine Bird Studies	James Sedinger
Mel Green	Fisheries Oceanography	Brenda Norcross
Jeff Harmen	Engineering	Kerry Stanford
Shirley Hootch	Sea Grant Intern	Elena Allers
Samantha Hoover	Mammalogy	Joseph Cook
Robert Hoth	Physical Oceanography	David Musgrave
	Fisheries Oceanography	Al Tyler
Beverly Johnson	Biochemistry	Larry Duffy
John Levno-Chythlook	Marine Invertebrates	Ken Coyle
Jennifer Litera	Biological Oceanography	Tom Kline
Patience Merculief	Mammalogy	Joseph Cook
Veronica Michael	Biochemistry	Larry Duffy
Kathleen Murphy	Fisheries Oceanography	Brenda Norcross
Senka Paul	Biochemistry	Larry Duffy
Tauni Rodgers	Mammalogy	Joseph Cook
Roy Roehl	Marine Geology	Sathy Naidu
	Paleo-oceanography	Bruce Finney
Rion Schmidt	Fisheries Oceanography	Al Tyler
Tai Sturdivant	Marine Macrophytes	Nora Foster
	Mammalogy	Joseph Cook
Robert Sundown	Biological Oceanography	Tom Kline
Kevin Vanhatten	Biological Oceanography	Ken Coyle
Charlene Zabriskie	Fisheries Oceanography	Brenda Norcross
Jack Zayon	Neurophysiology	Sven Ebbesson

In some cases, more than one mentor is associated with a student. We have encouraged varying the exposure to research by allowing students to work with more than one faculty member, if they so desire.

Table 2 presents information on student histories, including academic status and internship activity. Note that some of the students have remained with the program for several years and that, although some did drop out, a number have graduated and others are in their senior year and are making good progress.

Table 2. Student intern status and activities

Shannon Albright entered the program in May 1991 and is currently a senior. Her mentors have been Brendan Kelly and Ken Coyle. She has assisted Brendan Kelly in ecological studies of phocid seals and sea otters, including management aspects. She also conducted library research on harbor seal and sea otter biology, and developed an extensive bibliography. With Ken Coyle, she has sorted and identified benthic invertebrates, measuring and identifying amphipods, and recording data.

In August 1993, she monitored radio-tagged sea otters in the Aleutian Islands in conjunction with a U.S. Fish and Wildlife Service study of nearshore community ecology. She also participated in a cruise under the West Coast Undersea Research Program, utilizing a submersible in the eastern Aleutian Islands.

Lina Allen entered the program in September 1993 and was enrolled for one semester. She had two mentors, Sathy Naidu and Bruce Finney. She dropped out of the University in 1994. She prepared marine geological samples for analysis.

Karl Bergman dropped out soon after entering the program (1993). His mentor was Kerry Stanford. Karl worked for the Polar Ice Coring Office, as driller, draftsman, designer, and fabricator of ice coring equipment; he conducted some technical analyses and prepared a report.

David Broussard entered the program in January 1994. He is currently a sophomore. His mentor is Brenda Norcross. David has identified benthic materials to the family level and entered data.

Paul Brown entered the program in August 1992 and currently is a senior. His mentors are Ken Coyle and Al Tyler. Under Ken Coyle, he has sorted and identified zooplankton, whereas with Al Tyler he has worked on sea otters, collecting samples for microbial analysis. He participated in the three-week training program at the Kasitsna Bay Laboratory, and also carried out processed fish sampling for microbiological analysis along the Yukon River.

La-Ona Dewilde entered the program in September 1993 for one semester. She dropped out of the University in 1994. Her mentor was David Eslinger. She worked on satellite image processing and plotted data and assisted in the laboratory.

Alex Dugaqua enrolled in January 1994. She is currently a junior. Her first mentor was Laura Bender. She worked with the graduate student program, reviewing marine literature and

enhancing her computer skills with database applications. She is presently working with Kelly Drew looking at neurotransmitters using microdialysis.

Jason Evans was in the program for only the 1993 fall semester. His mentor was John Kelley. He worked on program analysis.

Terry Fitka entered in May 1992 and remained for 4 semesters. She is currently a junior. Her mentors were Kelly Drew and Jim Sedinger. She worked on sample preparation for neurophysiology and for marine bird studies.

Susan Gray entered the program in August 1994 and this is her first semester. She is a sophomore. She is learning autocad engineering drafting. Her mentor is John Kelley.

Mel Green entered the program in January 1993 and was involved for 2 semesters. His mentor was Brenda Norcross. He worked on larval fish measuring using a digitizing pad and computer, and assisted with library research. He also conducted marine studies at Barrow, Alaska.

Jeff Harmen entered the program in September 1991 and was involved for 6 semesters. He graduated in 1994. His mentor was Kerry Stanford. He worked on an autocad design project in the Polar Ice Coring Office.

Shirley Hooch entered the program in January 1994 for one semester, but dropped out of the University in 1994. She was a Sea Grant Intern and her mentor was Elena Allers.

Samantha Hoover entered the program in March 1993 and was involved for two semesters. She is presently a senior. Her mentor was Joseph Cook. She assisted with a lynx project, and also visited an arctic coastal research station and made observations in marine estuarine and oceanic environments.

Robert Hoth entered the program in January 1992, remained involved for four semesters, and is presently a senior. His mentors were John Kelley, Al Tyler and David Musgrave. He worked on computer design of a curriculum for marine acoustics, wrote an instruction sheet for using a scanner with a Macintosh computer and compiled a clip art file of marine scientific drawings. He also carried out data spread sheet work for a research project on pink salmon aquaculture at Auke Bay, and produced graphics related to data collected offshore from Sitka, Alaska.

Beverly Johnson entered the program in May 1993. She is currently a senior. Her mentor is Larry Duffy. Beverly developed immunochemical methodology for monitoring oil and PCBs in water. She has also worked on tissue analysis. She presented an abstract showing no detectable PCBs in bowhead whale red cells at the 4th International Symposium of the Conference of Asian and Pan-Pacific University Presidents, in Anchorage, Alaska, September 1993.

Phil Kugzruk entered the program in September 1991, stayed for two semesters, and graduated in 1992. His mentors were Jim Sedinger and Ken Coyle. He worked on marine birds in the Kuskokwim Delta and also learned invertebrate sample sorting and identification.

John Levno-Chythlook entered the program in September 1993 and stayed for two. He is currently a junior. His mentor was Ken Coyle. He worked on invertebrate sample sorting and identification.

Jennifer Litera entered the program in March 1992, and was involved for five semesters. She graduated in 1994. Her mentors were Sathy Naidu, Bruce Finney and Tom Kline. She assisted in preparation of geological samples, and also on the selection and preparation of fish samples for mass spectrometry. She participated in the three-week training at the Kasitsna Bay Laboratory.

Patience Merculief entered the program in September 1993, remained for two semesters and is now a sophomore. Her mentor was Joseph Cook. Although she was not involved long enough to conduct field work, she spent time during her internship learning library techniques.

Veronica Michael entered the program in November 1990 and remained active for eight semesters. She graduated in 1994. Her mentor was Larry Duffy. Veronica developed capillary electrophoreses analyses of fish hemoglobins, and co-authored a paper based on her work. She spent one week at Kasitsna Bay analyzing samples.

Kathleen Murphy entered the program in November 1991, remained active for six semesters, and is presently a senior. Her mentor was Brenda Norcross. She worked on separating larval fish from zooplankton, and on identification of benthic material to the family level and also conducted extensive library research.

Senka Paul entered the program in March 1991. He has worked with Larry Duffy on developing biochemical and immunochemical methods for monitoring marine ecosystems. He also participated in a one week field study at the Kasitsna Bay Laboratory.

Tauni Rodgers entered the program in September 1991, remained for 6 semesters, and is presently a senior. Her mentors were Ken Coyle, Jim Sedinger and Joseph Cook. Tauni worked on sample sorting for marine invertebrates, and received training in identification. She participated in marine bird studies conducted by the U.S. Fish and Wildlife Service, conducted post-season data processing, and also participated in a cruise of the R/V Alpha Helix to study oceanographic techniques. She also worked on cataloging, curation and sorting of museum specimens. She plans to go to graduate school.

Roy Roehl entered the program in August 1992, remained for four semesters, and graduated in 1994. His mentors were Sathy Naidu and Bruce Finney. He went to the laboratory of the Alaska State Division of Geological and Geophysical Survey, to get acquainted with the SediGraph and X-ray Diffractometer, and was trained to operate these instruments. He assisted in the analysis of the size distribution of suspended particles in water columns of Cook Inlet and is preparation of clay samples for x-ray diffraction analysis.

Rion Schmidt entered the program in September 1993 and is presently a senior. He has worked at the Seward Marine Center, assisting in crab and fisheries research. His mentor is Al Tyler.

Tai Sturdivant entered the program in September 1993 and is presently a senior. His mentors are Joseph Cook and Nora Foster. He has worked in the aquatic collection and the herbarium at the University of Alaska Museum, contributing to specimen processing and monitoring fluid levels in the plant collection, adjusting the alcohol concentration in each bottle. He participated in a small mammal inventory in south central Alaska, preparing genetic material and undertaking cryogenic preservation of specimens.

Robert Sundown entered the program in October 1990 and is a senior. His mentors have been Tom Kline, Ken Coyle, and Tama Rucker. He has carried out stable isotope analyses on fish and participated in a research cruise to the Bering Sea, where he assisted in the collection of benthic samples for an energetic study of benthic amphipods. He sorted samples and was trained in invertebrate identification. He has also taken on the added responsibility of helping to coordinate the intern program.

Kevin Vanhatten entered the program in January 1992, remained for five semesters, and graduated in 1994. His mentors were Ken Coyle and Gerry Plumley. Kevin was involved in research on isolating, cloning and sequencing the genes required for synthesis of the marine toxin involved in paralytic shellfish poisoning; he grew the algae, isolated DNA, performed routine biochemical tasks and was responsible for keeping detailed notes. He also learned sample sorting and invertebrate identification. He participated in summer field studies at Kasitsna Bay and also observed subsea volcanic vents using a small submersible.

Charlene Zabriskie joined the program in December 1991, remained for five semesters and is presently a senior. Her mentor was Brenda Norcross. She assisted in the final stages of report preparation, verifying pages and organization prior to submission to the printer. She was also involved in laboratory analyses and data entry, identifying benthic materials to family and verifying data entry. She participated in a research cruise in Kodiak.

Jack Zayon joined the program in May 1992, remained for 4 semesters, and dropped out of the university in 1994. His mentor was Sven Ebbesson. Jack worked on the capillary electrophoresis of saxotoxin.

The student interns are required to write reports associated with all field projects. These are often team-authored. A sample of the types of reports related to specific projects is presented in Appendix 3.

Native Perception of Scientific Research

One of the principal investigators (J. Kelley) serves as chairperson of the North Slope Borough Science Advisory Committee (NSB/SAC) and more recently on the steering committee of the proposed Alaska Native Sciences Commission (ANSC). It is clear that there is a great respect for science and scientific research among the Native community of Alaska. However, there is also concern that scientific activities are being driven from without the community, and also there is great concern over the lack of understanding of traditional Native wisdom.

This is a serious problem, which we are approaching by:

- Appointing a senior intern to act as student coordinator. This has worked out very well. The student coordinator serves as a role model.
- Encouraging co-authored papers (see Appendix 3).
- Strongly encouraging partnerships.
- Enrichment of our interns by having them participate with our graduate students and, when ready for the responsibility, to assist in the instruction.

Student Intern Outcomes

Examples of the subsequent careers for a few students will be highlighted here, to show the type of outcome which we have obtained:

Margie Derenoff was one of the first students in the program. She graduated, and after graduation continued to work with Raymond Highsmith on the Exxon Valdez oil spill assessment project. Following this, she accepted a position with a Native corporation in Kodiak as a community planning officer with responsibilities for marine conservation and aquaculture. Presently she is a finalist for a magistrate position at Tok, Alaska.

Veronica Jones, also a student in the early years of the program, graduated and plans to return to the University of Alaska Fairbanks to obtain a teaching certificate.

Tom Henry is co-manager of Arctic Tour, a part of the NANA Regional Corporation (Native) at Kotzebue. He and his wife plan to return to the University of Alaska Fairbanks in January to finish his degree. He has about one semester to go.

Brian Leal has a position in Rural Development with the Tanana Chiefs Conference (Native organization in interior Alaska).

Clarence Saccheus still needs 6 credits to graduate. He has been offered a position as Community Development Officer at Kawerak (Bering Straits Native Corporation) at Nome.

Robert Sundown will graduate this year and go to the University of Washington as a pre-medical student.

Shannon Albright will graduate this year in biosciences. She will attend graduate school next year. She credits the intern program for generating her interest in going to graduate school in the sciences.

Richard Glenn was an early participant in the program when he was completing his M.S. degree in geology. He helped to start the AISES (American Indian Science & Engineering Society) chapter at the University of Alaska Fairbanks. Subsequently, he decided to pursue a Ph.D. program in sea ice studies, and moved his residence to Barrow. Richard Glenn continues to pursue his research and also serves as Manager of Barrow Technical Services, Inc.

Clearly, the success of the program has been two-fold. First, some of the students are going into the sciences. Secondly, some of those that are not are pursuing scientific careers are accepting responsible positions in Alaska, often with Native corporations of governing bodies. In these positions, their scientific literacy will be an asset to them and to their communities.

Methods

The School of Fisheries and Ocean Sciences has 55 faculty and additional research staff distributed over 12 sites throughout Alaska, providing a great potential for fruitful learning relationships. Further, the graduate programs in Marine Sciences and Limnology and in Fisheries involve student research covering a very broad range of topics. In addition, faculty in the College of Natural Sciences, the Institute of Arctic Biology and the School of Engineering are available to work with students. Thus, a large pool of talent is available. In all cases, a portion of the student's time will be spent working with his/her mentor in the laboratory or field.

The faculty and staff mentors play an important role in the student's career. The mentor is expected to involve the student in a research project that will engage the student's interest in the sciences. This can take many forms, from participating in the actual laboratory or field work to entering data on a computer and assisting with report preparation, or other activities. Academic achievement is emphasized and the mentor nurtures a continuing interest in the student.

Faculty and research staff mentors are not paid specifically for the student mentoring, and we are fortunate that many faculty within the School of Fisheries and Ocean Sciences and elsewhere within the University of Alaska Fairbanks care about the problem of low involvement in the sciences and engineering by minorities. As a result, they are willing to put in the extra effort, and very few faculty have dropped out of the program.

Students in the intern program also will participate in a summer field short course at a coastal laboratory, and will carry out both team and individual projects while there. The Kasitsna Bay Laboratory has been the locus for this course, and is ideally suited. In addition to this field course, the coastal facilities will be available for summer intern work. In some cases, participation in research oceanographic cruises or in the undersea research program will be arranged. In the past, some students have also participated in local and national scientific

meetings, and this will be encouraged where appropriate.

Some of the activities which have been made available in the past to the students during the summer include:

- Participation in cruises on board the R/V Alpha Helix
- Dives on research submarines through the National Undersea Research Program
- Field studies in a number of areas including:
    - Sea bird studies in association with U.S. Fish and Wildlife Projects.
    - Invertebrate studies at coastal sites, including Kasitsna Bay Laboratory.
    - Fisheries oceanography and fish biology projects.
    - Internship with the Sea Otter Commission.
    - Internships/experimental work at the Seward Marine Center.
    - Limnological research in interior Alaska.

At the conclusion of the summer field period, a short report was prepared by each student on his/her work. As in the past, these reports will often be prepared as team reports based on collaborative work.

Coordination

Since a number of faculty and students were involved in the program, a coordinator was appointed for the project, with the responsibility of keeping track of student applications and admissions to the program as well as tracking mentor assignments, student research assignments, participation, and reporting; he/she also carried out the numerous communication tasks which were inherent in a program of this kind. Even more important, the coordinator was responsible for keeping the long-term records regarding student outcomes.

The success of the program is determined by tracking the progress of each student during his/her University of Alaska Fairbanks career and beyond. While it must be recognized that to date there are few obvious success stories for Alaskan Natives in scientific careers, there has been notable progress.

Recruitment of Interns

Recruitment of students was carried out in close cooperation with the UAF Rural Alaska Honors Institute and the Upward Bound Program and through AISES. In this way, it was possible to identify some potential applicants for the program prior to their enrollment at the University of Alaska Fairbanks. Students were identified from the already-enrolled student body as well. An information sheet soliciting applications was made available, and applicants were asked to provide a brief statement of their background and the reason for their interest in our program. They were asked to provide the names of at least two people familiar with their academic background.

Candidates were presented with:
- program description
- qualifications
- intake questionnaire
- student interview questions

Students were admitted to the program based on information presented in their applications and in letters of recommendation.

Following admission, each student was interviewed and completed a brief questionnaire, and then was assigned to a mentor. The student was asked to help with laboratory or field tasks. Frequent meetings and discussions with the mentor ensured that the student is performing appropriately.

Students (and mentors) will be tracked annually with a survey which addresses the effectiveness of the relationship and the program from their perspectives. Further, we will continue to send questionnaires to former interns to track their progress.

Each internship carried with it a waiver of tuition and the opportunity for the student to work not less than 5 nor more than 20 hours per week.

Partnerships and New Initiatives

Alaska is a large state. In the past it has been practical to recruit our students through the university, and they represent a broad geographic distribution within the state. However, we wish to explore more vigorously the possibility of establishing partnerships or joining in alliances with other institutions. Towards this end, we have established (as of October 1994) a program through the National Oceanic and Atmospheric Administration (NOAA) to train Native students with a special emphasis on marine and atmospheric contamination of the arctic coastal regions. This project is supported through a NOAA cooperative center recently established at the University of Alaska Fairbanks.

It is our desire to continue to build partnerships and develop an effective network within Alaska to reach and influence more college-level Native students to pursue careers in science, engineering and mathematics. The following initiatives are underway or planned:

1. We have entered into discussions with a parallel project team at Oregon State University (OSU) to discuss the merits of forming an alliance between our program and the OSU program. The advantage of such an alliance would be opportunities for exchange of training opportunities for Native students from both sides. We have sent our students to sea in collaboration with students from Oregon and Washington and this has been successful.

2. We are entering into negotiations with the Alaska Department of Fish and Game (ADF&G) with respect to a partnership which will allow our students to spend summers on marine or wetlands projects with ADF&G scientists and to possibly follow up on laboratory analyses and report preparation during the winter.
3. We will continue to seek arrangements for our students to participate in programs with the Marine Advisory Program (MAP). MAP is a unit within the School of Fisheries and Ocean Sciences, with programs and offices at a number of coastal sites around Alaska. Interest has been shown to accept our interns at Sitka during the summer to work on fisheries problems through one of the Native corporations. Their work would be supervised by the resident Marine Advisory Agent, Dolly Garza, a Native Alaskan.
4. Over the past few years we have had beneficial collaboration with the U.S. Fish and Wildlife Service in the Yukon-Kuskokwim Delta for which our interns and faculty gained support.
5. The Native regional corporations established under the Alaska Native Land Claims Settlement Act (ANILCA) are also excellent candidates for partnerships. Nearly all of them have a charter to enhance the education of the members in their region. We have made several attempts to generate active interest from the regional (and community) corporations, but they have not been successful. We did have excellent and generous support for one of our marine studies programs out of Barrow, Alaska, however.

We have explored what other programs are accomplishing, primarily through attendance at the American Indian Science & Engineering Society (AISES) meetings. We contribute to AISES, Upward Bound and Rural Alaska Honors Institute (RAHI) through this project, as they are the primary organizations for recruiting and screening candidates for our program. A representative from the School of Fisheries and Ocean Sciences accompanies our interns to the AISES annual meeting. We also encourage our participating mentors to take selected interns to the American Society of Limnology and Oceanography meetings or other conferences, particularly if a paper is being presented based on work in which the intern participated.

The opinion of our interns and school representatives at the AISES conferences leads us to believe that this is one of the best opportunities to share experience and encourage our own students.

APPENDIX 1

A comparison of FY92 Native and Non-Native Degree Recipients by Degree Attainment and Selected Demographic Characteristics

University of Alaska Fairbanks - Institutional Research Series

No. 92-6

A Comparison of FY92 Native and Non-Native Degree Recipients by Degree Attainment and Selected Demographic Characteristics

INTRODUCTION.
How well is the University of Alaska serving the Native Alaskan population of the State? Initial indicators of how well UAF is doing regarding program instruction can be derived by looking at Native Alaskans that graduate and analyzing graduate characteristics such as the graduation rate over time to determine the extent trends are changing; the degree level mix that Natives have compared with the non-Native student body; the disciplines that Natives choose compared to non-Natives; where students come from and comparing characteristics such as age and gender with what degrees were attained; and how much financial assistance was secured to complete a course of study. This institutional research report, the second on this topic in the series, provides a summary look at Native Alaskan degree trends since FY75 and more detailed analysis of the most current year's statistics for FY92.

METHODOLOGY.
This analysis required an extensive review of all 712 FY92 degree recipient records to ensure proper and complete ethnicity, gender, age, financial aid, origin, and degree data. To determine the amount of financial aid that a graduate received while studying at UAF, all financial aid hardcopy files kept in the Financial Aid Office for each of the 712 FY92 degree recipients were pulled and hand tallied. To ensure the completeness of aid information, data tallied for Alaska State Student Loans were cross-checked with a data extract provided by the Alaska Commission on Postsecondary Education. Where discrepancies existed (which occurred in less than 8% of the graduates), ACPE data overrode the institution's tally. Due to the incomplete and fragmented nature of recording student assistance data at UAF, it was not possible given the scope of this study to include the monetary value of all waivers ever received, total graduate assistantship dollars received, and non-work-study PT student employment. Rural Student Services provided assistance in identifying Alaskan Natives and their community of origin. In view of problems using a student's current and permanent address to determine where they originated from, the high school a student graduated from was defined as the student's origin for this study.

RESULTS.
In FY92, 12% of all degree recipients were Native. This equalled the proportion for the previous year.

Figure 1. Since the late 1970's, the number of Native Alaskans completing bachelors degrees has steadily increased, with over 50 graduating in FY92.

Figure 2. The proportion of Native graduates in Certificate and Associate programs is approximately twice the non-Native proportion for programs at this level. Natives received less than one-fifth the proportion of masters degrees as non-Natives, and only one Native Alaskan has ever received a doctoral degree (FY79).

Figure 3. Education, General Studies, Public Affairs and Health were FY92's most popular disciplines for Native graduates while Business, Engineering, Education and Social Sciences were the most popular for non-Native graduates.

Figure 4. Native and non-Native graduates had relatively proportionate age cohort percentages within most age groups. Thirty one percent of the Native and 25% of the non-Native graduates were over 35 years of age.

Figure 5. On average, Natives acquired more financial aid than non-Natives during the course of their studies at UAF. Over 42% of Native graduates received loans, grants, scholarships, and work-study financial aid that exceeded $25,000; 8% of non-Natives did. The median aid received by Natives was $22,119 compared to $12,136 for non-Natives.

Figure 6. The greatest proportion of FY92 Native graduates came from the Lower Kuskokwim, Fairbanks, and Bering Straits areas. Only 1 graduate came from Southeast Alaska.

Figure 7. Eskimo groups made up the largest proportion of FY92 Native graduates, at 60%. No Native graduate was Southeast Indian.

Figure 8. A higher proportion of Native graduates were female. Approximately 74% of all FY92 Native graduates were female; 47% of the non-Native graduates were.

Figure 9. One out of four Native graduates came from urban areas.

For additional copies or information concerning this institutional research report, contact PCIS @474-6638.

FIGURE 1. FY75-92 UAF Native Bachelors Degree Recipients Trend

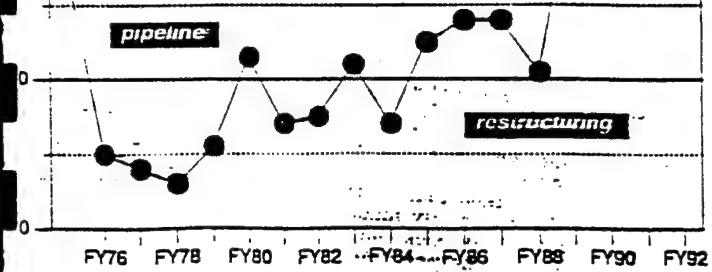


FIGURE 2. FY92 UAF Native / Non-Native Degree Recipients by Degree Level

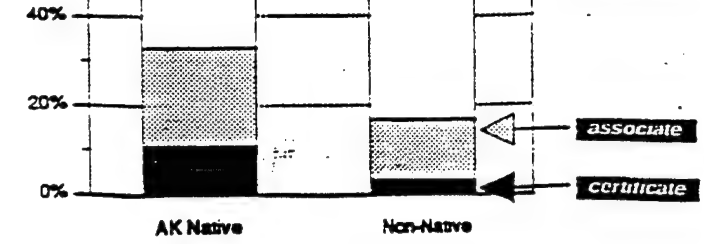


FIGURE 3. FY92 UAF
Native / Non-Native Degree Recipients by Degree Discipline

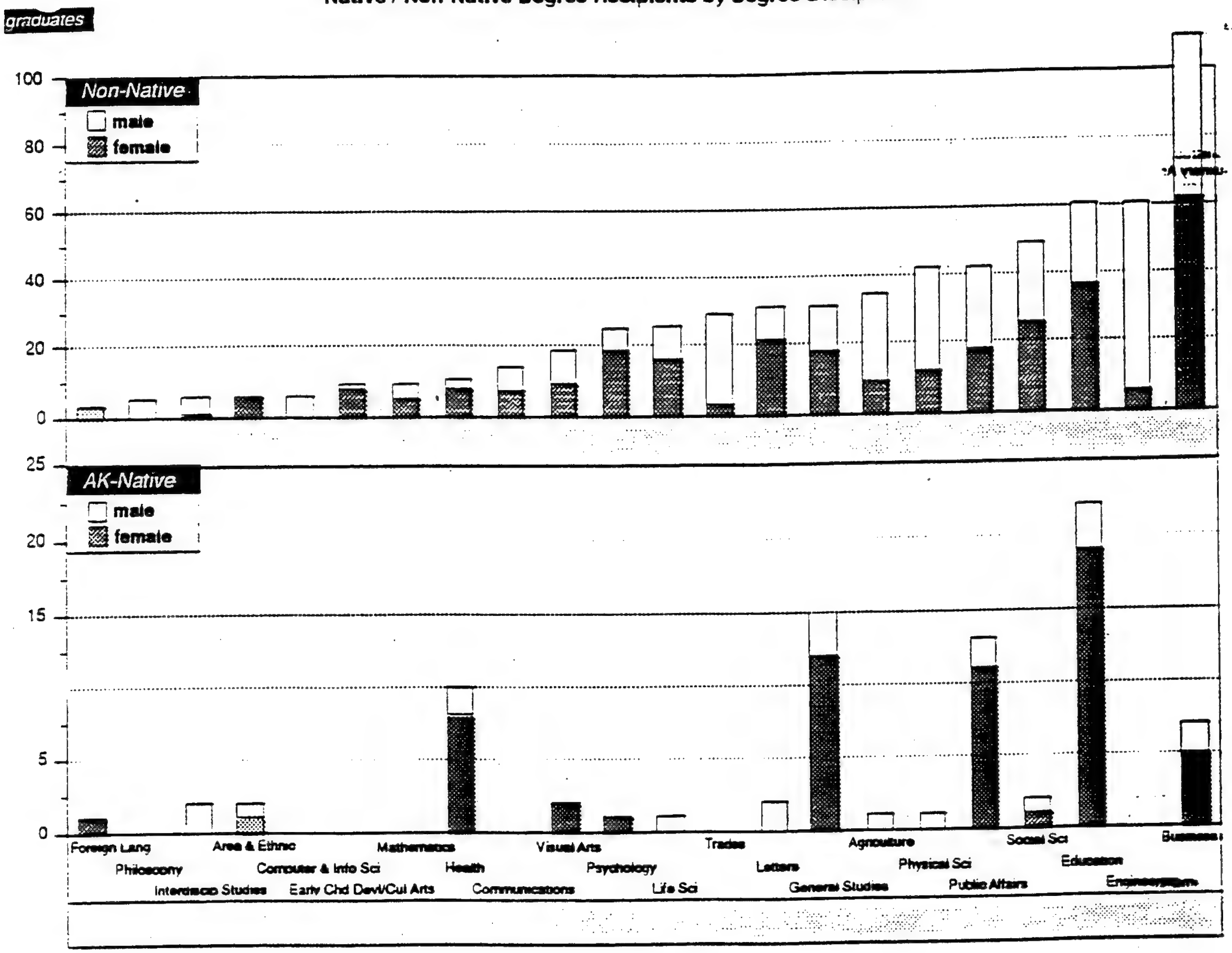


FIGURE 4. FY92 UAF
Native / Non-Native Degree Recipients
by Age Cohort

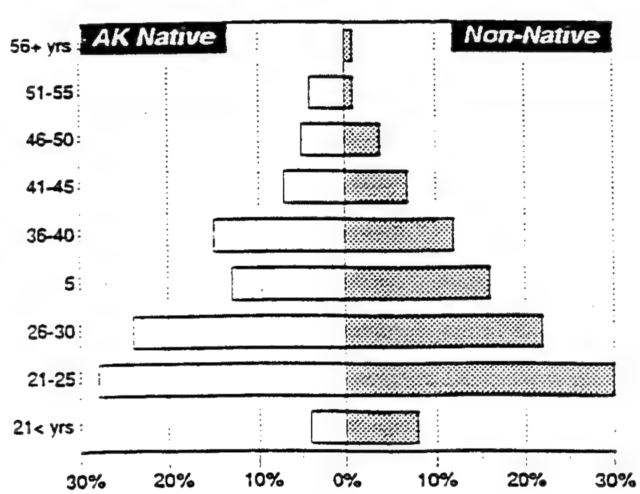
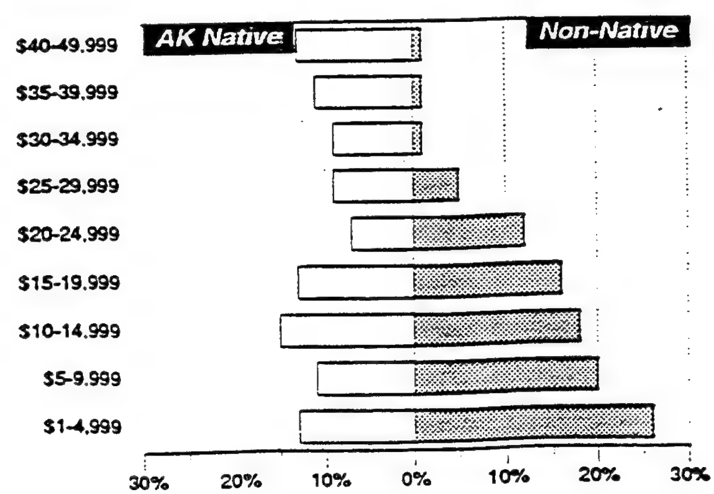


FIGURE 5. FY92 UAF
Native / Non-Native Degree Recipients
by Aid Cohort



Comparison of Native and Non-Native Degree Recipients

December 1992

F RE 6. FY92 UAF
Native Degree Recipients
by Region of Origin

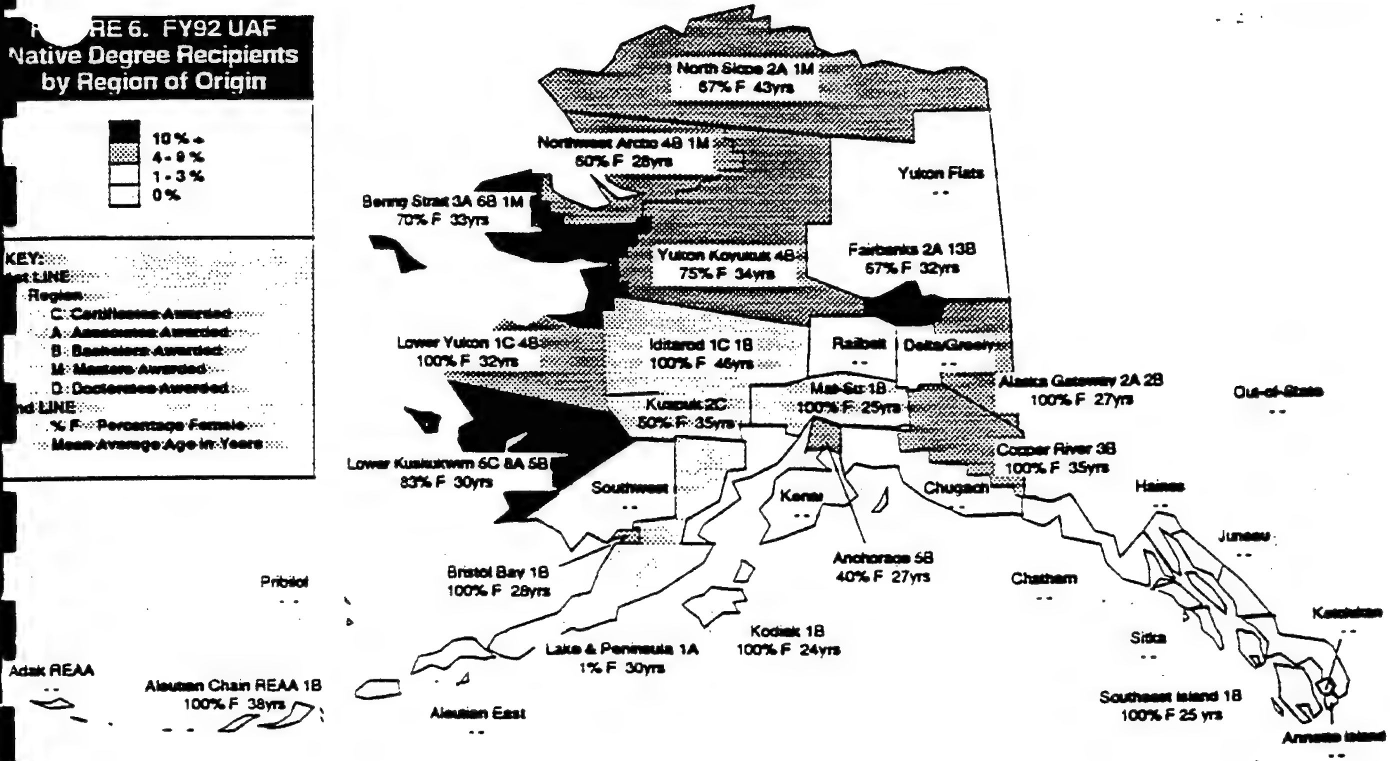


Figure 7. FY92 UAF
Native Degree Recipients
by Native Group

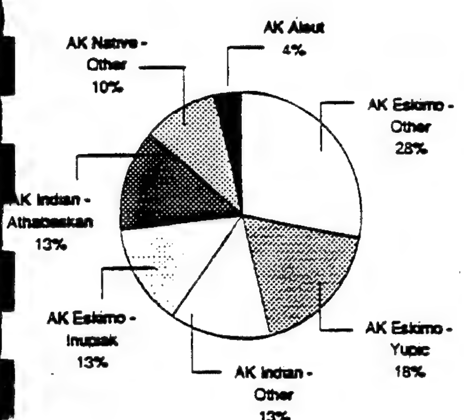


Figure 8. FY92 UAF
Native / Non-Native Degree
Recipients by Gender

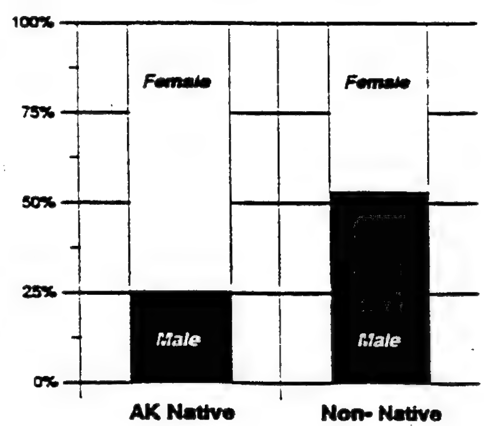
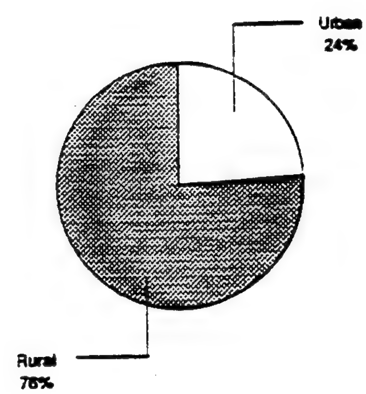


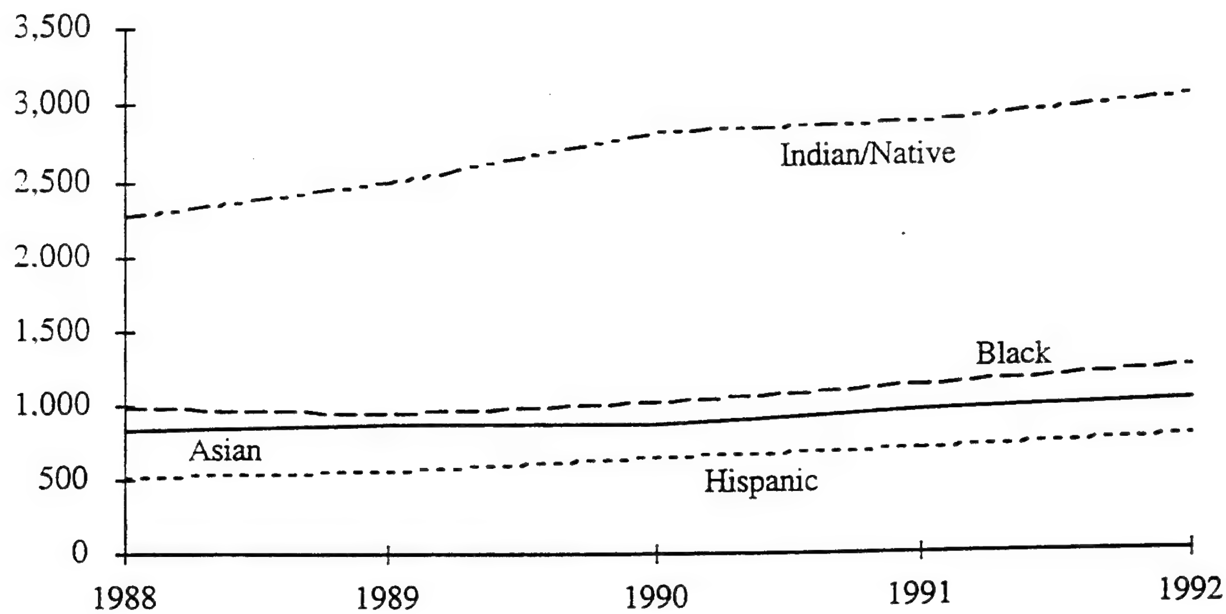
Figure 9. FY92 UAF
Native Degree Recipients
by Urban / Rural Origin



University of Alaska Fairbanks
Office of Planning, Computing & Information Systems
201 Eielson Building
Fairbanks, Alaska 99775-0885

John Kelley
Director
Polar Ice Coring Office
(VCR)

Trends in Minority Student Population 1988-1992



In 1990, 8.4% of UA students were Indian or Native, 3.1% were Black, 2.6% were Asian, and 2% were Hispanic. Whites made up 78.5% of the student population and 5.6% were of unknown ethnicity. Nationally in 1990, Indians and Natives accounted for 0.8% of all students. Black students made up 9.2%. Asian students were 4.2%, and 5.7% were Hispanic students. The national White student population was 80.2%, down from 81.1% in 1988. Between 1988 and 1990, minority populations nationwide slightly increased their proportional representation (NCES Digest of Education Statistics 1992).

APPENDIX 2

Project Evaluation

Project Evaluation

Student Role

The program seeks the involvement of Alaskan Native undergraduates and expects their active participation. It is a unique program that offers the interns an opportunity to receive both formal training and participate in laboratory and field work. A faculty or staff member acts as mentor to the student, employing them in the laboratory and nurturing the student academically. All students are required to participate in marine field station experiences which familiarize them with field conditions, sampling, data collection and other aspects of work outside the laboratory.

Laboratory training is an indispensable part of developing an understanding of the current limitations and available techniques in which various scientific tools are used to help answer questions. Interns work in paid positions in various laboratories on the University of Alaska Fairbanks campus. Dr. Joseph Cook, Curator of Mammals with the University of Alaska Museum has students assisting with the preparation of study skins, cataloging of specimens, and data entry on the computer. In Dr. Larry Duffy's biochemistry lab, students have worked on projects developing biochemical and immunochemical methods to monitor the marine ecosystem. In the laboratory of Dr. Raymond Highsmith and Ken Coyle, interns utilize microscopes to key out species of amphipods, zooplankton and other marine invertebrates. Interns also collected specimens in the field. On one project, they worked in a miniature submarine and used various sampling tools to collect benthic amphipods from the Bering Sea. Several students have interned with Dr. Brenda Norcross, working on projects involving flatfish, which included identification of marine animals and invertebrates, data input, library research and report preparation. Students are involved in many other projects on the Fairbanks campus as well as off-campus, and have the possibility of becoming involved in as many projects as their schedule and interests will allow.

Marine field station experiences are an integral part of the program and expose interns to field conditions in camps and aboard ship, as well as field sampling techniques. In conjunction with the graduate level course MSL 625 'Shipboard Techniques', students participate in

a short cruise during Spring Break. Students can go to Kasistna Bay Laboratory, which has a variety of marine environments where students may observe birds and marine life in terrestrial, intertidal, pelagic and benthic habitats, collect specimens and data, and perform experiments. There is a well equipped laboratory at Kasistna Bay to assist with their studies. The Seward Marine Center is a nationally prominent subarctic marine research station, and also the home port of the research vessel the Alpha Helix. Students can participate in research projects at the marine center or on cruises that leave from Seward. The research vessel Alpha Helix is owned by the National Science Foundation and operated by the Institute of Marine Science at the University of Alaska Fairbanks. The Alpha Helix is maintained and used for oceanographic research on the open ocean and in Alaska's shelf and coastal waters. It has laboratory space, storage space for specimens, and other areas for research purposes as well as living quarters for crew and scientists. The summer field station opportunities are an excellent method of motivating the students to study the marine sciences. They're fun, exciting and a wonderful opportunity for the students to see science in action.

Classroom work is not neglected while the student is involved in the program. In order to remain in good standing academically, which is required to participate in the program, a student must maintain a grade point average of 2.0. Students are asked to take MSL 111, a class titled 'The Oceans'. It is a study of the oceans from the broad perspective offered by combining insights from biology, physics, chemistry and geology. Societal questions related to fisheries management, global climate change, and pollution are also discussed. The student's mentor is expected to be a source of encouragement and help academically, particularly if a student is having a difficult time with a class. A tuition waiver is granted to the student at the beginning of each semester.

The program has affected many students interested directly in the Marine Sciences as a career option as well as those who will pursue careers in other sciences. Students build confidence in their knowledge of the scientific thought process through steady nurturing in the laboratory, experience with scientific equipment, field station work and classroom studies. For all the students, this is an important step in their future, regardless of whether or not they pursue the marine sciences as a career option.

John Kelley, Professor
University of Alaska Fairbanks
Fairbanks, Alaska 99775

Dear Dr. Kelley:

This letter will summarize our discussions of recent weeks regarding the training which I could cover while working with the Alaska Native Enhancement Program. As we discussed, our intent is to show how Total Quality Management techniques can be successfully applied to the unstructured worlds of education and community development.

A QUALITY BASED PARADIGM FOR THE ALASKA NATIVE ENHANCEMENT PROGRAM WITH THE UNIVERSITY OF ALASKA FAIRBANKS

I. Develop a strategic educational and training program to enhance the population of Alaska Natives in the sciences.

- A. Identify preliminary goals and objectives for the program
    - 1. It is important to differentiate the program goals and the individual student goals
    - 2. A "visioning workshop" with students, faculty and others concerned with the program is a good means for identifying preliminary goals and objectives
    - 3. All objectives must be viewed as flexible. The workshop should be held at least annually so that objectives can be revised as our program is further clarified
- B. Identify activities which promote achievement of the goals and objectives
    - 1. Countless proposed activities will come from the visioning workshop
    - 2. Student and faculty will select these activities and inspire enthusiasm with the program

II. Develop a work/reward plan

- A. Make a list of tasks required to accomplish the activities selected
    - 1. Clearly differentiate roles of management, staff, students and others

2. For each of the "players". list tasks required to accomplish each activity
3. Identify competency lists for each tasks
4. Develop training plan that assures each worker access to required competencies. This is especially important for students
5. Develop plan for providing recognition to students upon completion of tasks. e.g. certificates for participants in certain programs

B. Develop Specifications with clearly describe successful completion tasks

C. Develop charts to show flow of tasks
1. milestone chart
2. PERT Chart

D. Develop list of additional organizational and financial resources which can be mobilized to help accomplish tasks

III. Periodically review basic assumptions behind strategic plan and work plan

A. Are plans educationally appropriate?

B. Do plans promote efficiency and quality?

C. What are other programs doing in response to their programs?

I look forward to working with you on this project. This is just a draft outline. but I think that it is a lot of work and a start that the program would only benefit.

Sincerely.

Jason C. Evans

Jason C. Evans

Professor
Institute of Marine Science
University of Alaska Fairbanks
Fairbanks, Alaska 99775

FROM: Robert Sundown
Senior, UAF
Alaska Native Marine Science Enhancment Program

RE: Study of the Effectiveness of the Alaska Native Marine Science Enhancement Program: Results of Survey

DATE: August 3, 1993

INTRODUCTION

The Alaska Native Marine Science Enhancement Program has touched many students interested directly in the marine sciences as a career option as well as those who will pursue careers in marine or coastal related areas.

This program is unique in that it offers the students an opportunity to recieve both formal training as well as nurturing though association with a faculty member and participation directly in laboratory work. Furthermore all students are required to participate in marine station exercises which framiliarize them with all areas of marine sciences, including chemistry, biology, physics, and geology.

This study was designed to assess the effectiveness of the program in terms of the opinion expressed by present and former participants and interested faculty.

METHODS

To assess the effectiveness of the program, a questionaire was developed to answer two basic questions:

a. How the program can be modified to more effectively educate students

b. How the University enrollment of Native marine science interns can be enhanced

Two questionaires were developed to evaluate the program and generate ideas for improvement. To maximize return each questionaire had to be concise (see APPENDIX A.) The first survey with five questions was directed at current and former interns is the "Intern Questionaire" which involves the ideas and reccomendations of interns to evaluate the program. The second survey with four questions (Enhancement Survey) was directed to faculty (primarily of R.S.S.) and interns as well to gain an overall perspective on how the program can be made more effective and increase participation.

interested faculty and 14 Intern Questionaires & Enhancement Surveys were mailed to former and current interns.

CONCLUSION

Currently, 4 of the 29 Enhancement Surveys have BEEN returned and 5 of the 14 interns have responded. In general, both faculty and interns regard the program as effective. Interns are utilizing skills learned in the program, including my involvement as an intern and participation later in the Upward Bound Math/Science Program as a Marine Science Tutor which utilized skills I learned as an intern to teach various aspects of marine science to rural high school students.

There are specific comments I feel would enhance the education of interns and the progaram in general:

- Develop a relationship with High School students through the Upward Bound and RAHI programs. Upward bound has a Marine Science class within the Math/Science program.

- Increase advertisment thoughout campus and begin recruitment early in the academic experience so students see a purpose for struggling though science courses. Increased advertisment was the single largest recomendation which would be effective with the increased availability of funding. Currently the program is advertised though the College of Rural Alaska and the American Indian Science and Engineering Society (A.I.S.E.S.) to which this program contributes support of sending students to the annual meeting.

- Implement several meetings with interns several times during the course of a semester to evaluate the program.

The combination of hands on experience through lab work and field trips, financial aid through a tuition waiver and a stipend, and close association with faculty are an effective means of giving insight of science disciplines to interns.This program effectively motivates,trains, rewards, nutures, and retains students in their chosen science fields as the results of the survey indicate

APPENDIX 3

Samples of Student Reports of Projects Conducted Individually or as a Result of Team Effort

PROPERTIES OF LIGHT & WATER INTERACTION
Kachemak Bay Sites

a report for the

Alaska Native Marine Science
Enhancement Program

by

Robert W. Sundown

September 17, 1992

ABSTRACT

Marine phytoplankton utilize light for the production of oxygen from carbon dioxide. A tool used to measure the amount of light available at different depths and locations is the photometer. A photometer was used in the quantitative analysis of light availability at three sites (Gull Island, Ja kolof Bay, and Halibut Cove) on the South shores of Katchemak Bay. A declining exponential value of scattered light availability was measured as depth increased. Light reflected from the bottom of the ocean remained constant as depth increased.

INTRODUCTION

Three sensors were used for analyzing light intensity in air, diffuse (scattered light in the ocean) , and upwelled. Solar radiation incident on the water surface was measured with a light sensor. The diffuse sensor measured scattered light available between 400 and 700 nanometers (light utilized by phytoplankton) at different depths. The downward looking sensor measured light reflected from particles (upwelled) in the ocean. Photons of light were measured in moles of photons per second meters squared or Einsteins. Light is important in the continuing production of oxygen by marine phytoplankton. Oxygen is the primary molecule catalyzing metabolism in many forms of marine life and includes many species linked in the food chain. The production of oxygen is directly related to the light availability and intensity available at different strata and locations throughout the ocean.

This study measures light availability and intensity for utilization by marine life at three sites. Fourteen measurements were taken throughout 30 meters of the water column near Gull Island in Kachemak. Four locations (Fig. 1.8) through Ja kolof Bay were studied and are identified as locations J1,J2,J3, and J4. At location J1, ten measurements were taken at one meter intervals to ten meters of depth. At J2 five measurements were taken at one meter interval to five meters of depth. Location J3 also had five measurements throughout five meters of depth. One measurement at one meter was taken on site J4.

The last site was Halibut Cove where four readings were taken throughout four meters of depth. The sample site was in the Halibut Cove Narrows (see Fig.1.7.)

MATERIALS & METHODS

The device used to measure the light availability at the three locations (air, diffuse or scattered light throughout the ocean, and upwell) is the photometer. The device is the

LICOR Radiometer which measures light intensity in air, diffuse at different depths, and upwelled. The unit used to measure the amount of light is the Einstein, which is a Mole of Photons (6.02x10e 23 light particles.) Micro Einsteins/Seconds x Meters squared were the units x100 on all measurements taken.

The device consists of three light sensors, a microprocessor, and an interface link for the three sensors. Two sensors (upwell and diffuse) are attached to an aluminum T frame where the spherical diffuse sensor and the upwell sensor are mounted on opposite sides of the T frame. Thirty meters of graduated cable connects the sensors used to measure depth as well as transmit information to the microprocessor. A minimum amount of measurements was dictated by the depth of the site. If a site was five meters deep, four or five readings were taken at meter increments. Each reading gave three pieces of information, the air, diffuse, and upwelled measurements. The microprocessor interpreted all electronic signals from the three sensors. Functions available on the microprocessor were a time integrator which averaged measurements taken at 1, 10, 100, and 1000 second intervals. All measurements were taken at 1 second intervals. A second function on the microprocessor is the multiplier which adjusts for fractions of MicroEinsteins according to light intensity and availability. The multiplier was kept on x100. The last two functions allowed for change between sensors since only one LCD screen was available.

The procedure for taking readings is simple. The T frame with the two sensors was lowered in meter increments into the ocean once the boat came to a complete stop and measurements were taken at meter increments until we ran out of cable or the depth of the site prevented deeper readings. At each meter reading the LCD screen gave a figure which was recorded as seen in Tables 1.1, 1.2, 1.3 as raw data.

RESULTS

Table1.1 Gull Island

Gull Island, of all the sites gave the most complete set of data points. With 30+ meters of depth, ten consecutive reading were taken and in increments of five meters after the tenth meter until 30 meters was reached.

Meters	Air	Diffuse	Upwelled
1	6.30	6.20	0.40
2	6.70	3.40	0.30
3	6.70	2.00	0.27
4	6.80	1.30	0.22
5	6.70	0.97	0.20
6	6.85	0.75	0.19
7	6.50	0.55	0.20
8	6.40	0.41	0.19
9	6.34	0.35	0.19
10	6.34	0.29	0.19
15	6.30	0.12	0.17
20	6.37	0.06	0.17
25	6.43	0.04	0.17

30	6.60	0.02	0.16

Table 1.2 Ja kolof Bay

Three sites (see Figure 1.8) were sampled in Ja kolof Bay. The results were somewhat diverse. Site J1 with the greatest depth produced the most complete data set. Site J2 & J3 each yielded five meters depth of information. Site J4 gave only one meter worth of information (Air= 5.7, Diffuse=3.5, and Upwelled=7.3) not quite enough datapoints to plot. Site J4 was closest to the stream mouth and the shallowest sampling site in Jackolof Bay.

Meters	Air	Diffuse J1	Upwelled J1
1	6.35	5.08	0.25
2	6.39	5.83	0.22
3	7.11	2.90	0.19
4	7.66	2.36	0.17
5	14.37	2.35	0.16
6	7.37	1.77	0.14
7	8.8	1.38	0.13
8	7.98	1.07	0.12
9	8.66	0.90	0.12
10	7.963	0.68	0.12

Meters	Air J2	Diffuse J2	Upwelled J2
1	4.89	3.50	0.59
2	5.24	2.74	0.53
3	5.53	2.44	0.48
4	4.74	2.19	0.35
5	7.59	1.88	0.32

Meters	Air J3	Diffuse J	Upwelled J3
1	4.40	3.78	0.48
2	4.36	2.48	0.40
3	4.42	2.16	0.33
4	4.14	1.80	0.30
5	4.21	1.41	0.27

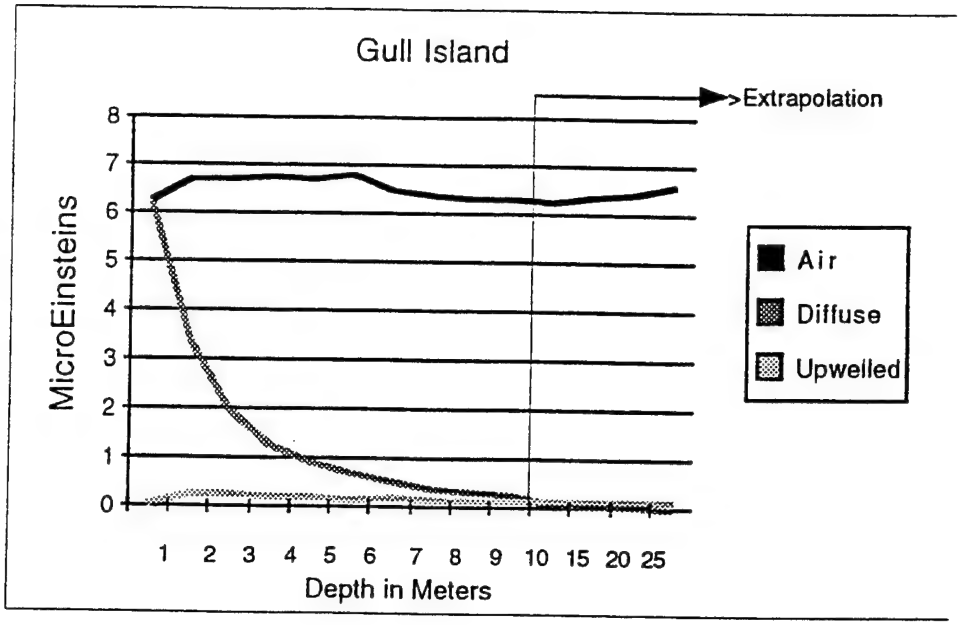
Table 1.3 Halibut Cove

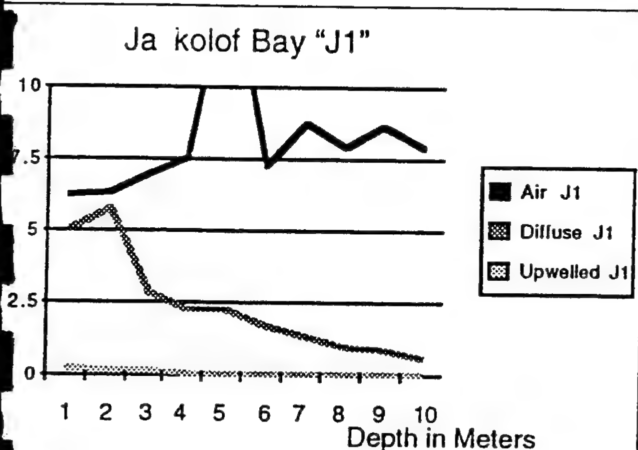
The Halibut Cove sampling site was 4.2 Meters deep. Only the first meter Air sensor reading was taken.

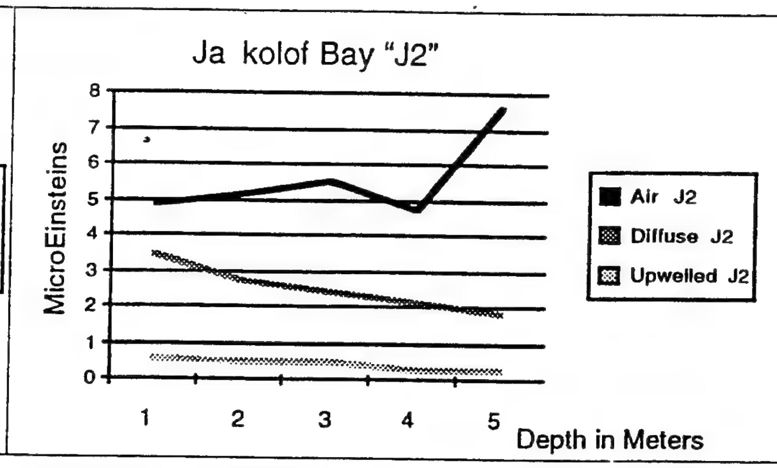
Meters	Air	Diffuse	Upwelled
1	7.82	4.24	0.82
2		3.72	0.72
3		3.14	0.64
4		2.39	0.58

ïgure 1.1

ıstrates light penetration as a ınction of depth. A declining xponential curve represents the ffuse. Time is responsible for ne fluctuations in the Air plot as ouds pass and occationally ock sunlight. The Upwell plot emains fairly constant roughout 30 meters of depth.







ure 1.2

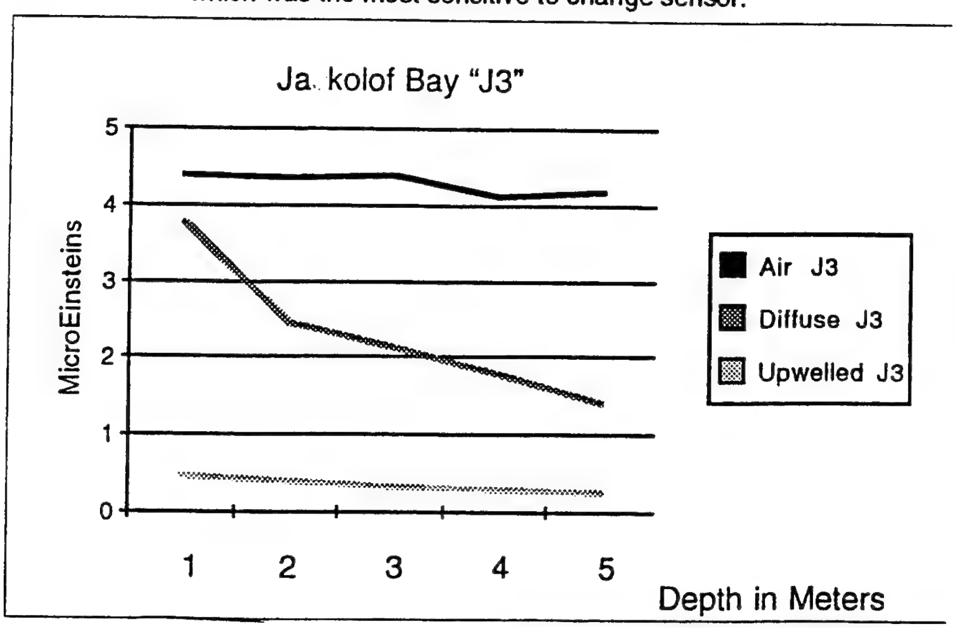
strates plots of J1 at the mouth of Ja kolof Bay (see re 1.8) in which the deepest readings were taken respect to J2, J3, J4 locations. The air plot peaks at 37 MicroEinsteins on the fifth meter .

Figure 1.3

Location J2 is located farthur into Ja kolof Bay. Five measurements were taken as opposed to ten at location J1. Partial cloud cover resulted in the fluctuation of the Air plot which was the most sensitive to change sensor.

ure 1.4

J3 was the farthest site into Jackolof chartable by multiple readings with radiometer. The declining onential curve for the Diffuse plot is n distinct from the other two plots.



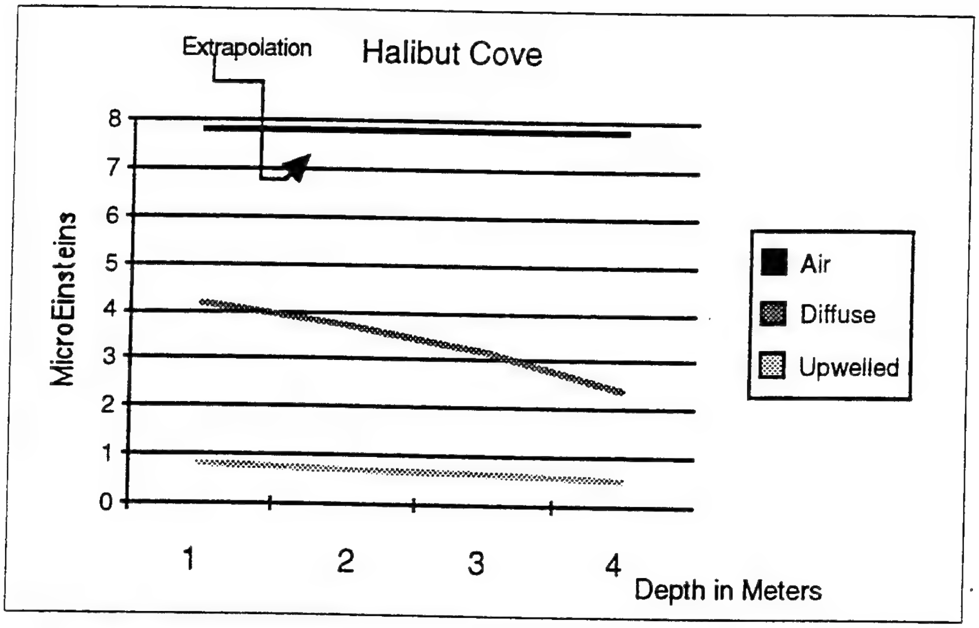


Figure 1.5

Halibut Cove produced the least amount of data becaase of the shallow waters. Four measurements were taken for the Diffuse and Upwelled sensors but only one for the Air sensor.

DISCUSSION

Gull Island with 30 meters+ of depth, gave the most complete figures and ease in interpreting once the information was graphed as seen in Fig. 1.1. Diffuse light intensity diminished exponentially. Light availability remained fairly constant for the air sensor. The fluctuations represent the change in time and the sun passing through clouds on an overcast day. There is a slight decline in the upwelled reading. This is probably do to the diminishing availability of scattered light. More true reading is gained at greater depths.

Multiple sites were measured at Ja kolof Bay. A stream empties into Jackolof Bay and may stir up sediment at sites closer to the mouth of the stream. Site J1 was farthest from the stream just outside the bay and site J4 was closest to the stream. The air readings represent for the most part a change in the position of the sun from 10:20a.m. to 2:00p.m. and the graph is an integration of the air reading for the time period between 10:00a.m. and 2:00p.m. For a more complete understanding see Table 1.2. The diffuse readings are somewhat more difficult to interpret. At the site farthest from the mouth of the stream, J1 had the most intense light penetration and light availability for phytoplankton. As J2 was located closer to the mouth of the stream the light penetration and availability was more variable than that of the farthur site J3. See Fig. 1.2. and

compare to the Air plot in Fig.1.3. There was only one measurement taken at site J4. Site J4 was not plotted. Relevant figures are recorded in Table 1.2. A unique correlation is seen when comparing the upwelled record. The deepest site J1 had the least reflectivity. Site J2 had higher reflectivity than J3 which suggests that J3 has more particulates preventing reflectivity.

Within Halibut Cove five measurements were taken. An exponential decline of light penetration is observed with the diffuse sensor (Fig.1.5.) Halibut Cove is a shallow site with a slightly higher upwelled reading than other sites. Air sensors measured nearly constant values in the three minutes of measurements that were taken.

CONCLUSION

Light is available and useful throughout different depths in the ocean for the production of oxygen by phytoplankton. The photometer is a useful instrument for sensing available radiation in the photosynthetic active range at different locations. A exponential curve is demonstrated when charting the values of the diffuse sensors. Einstiens remain fairly constant for the upwelled values throughout different depths.

Figure 1.8

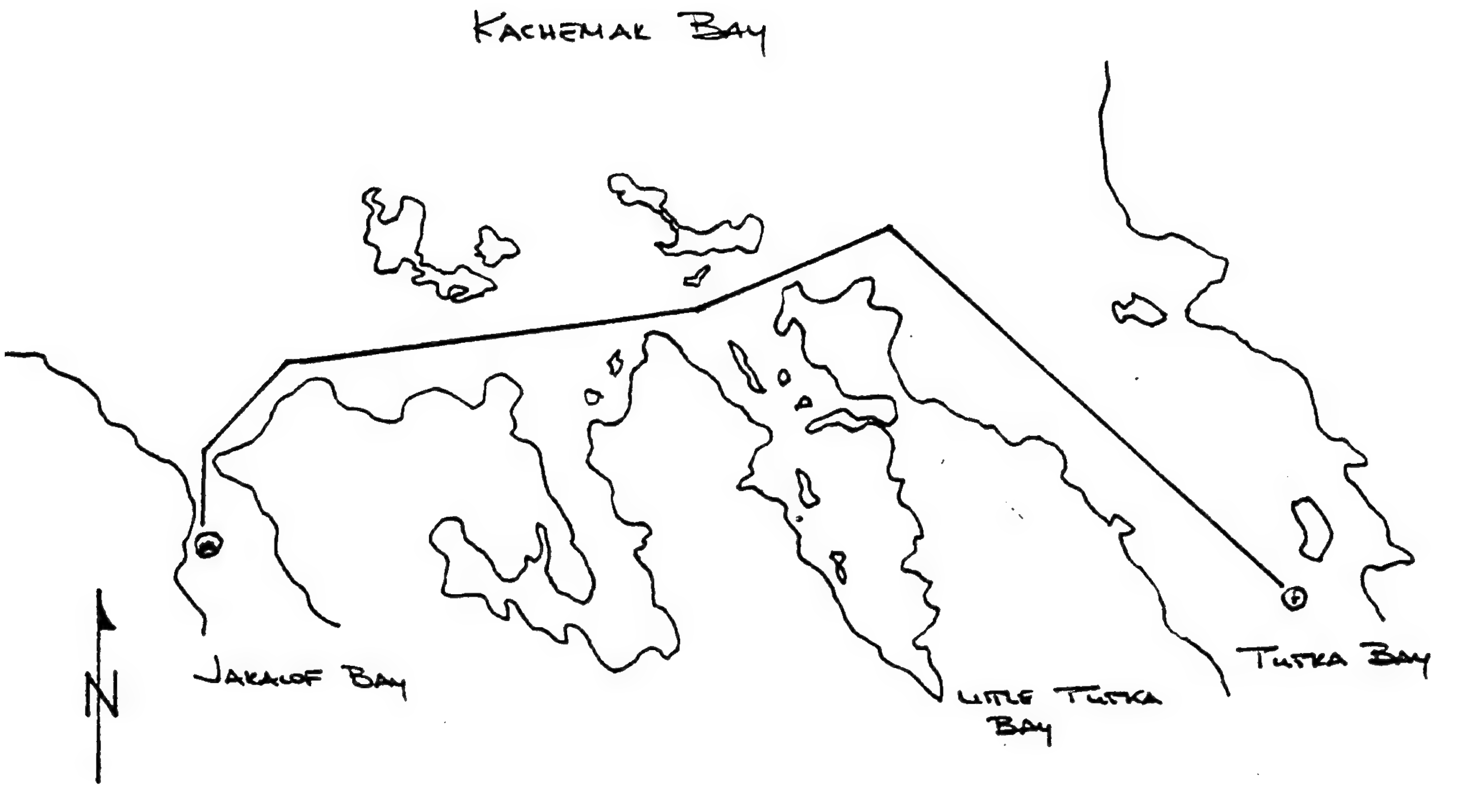
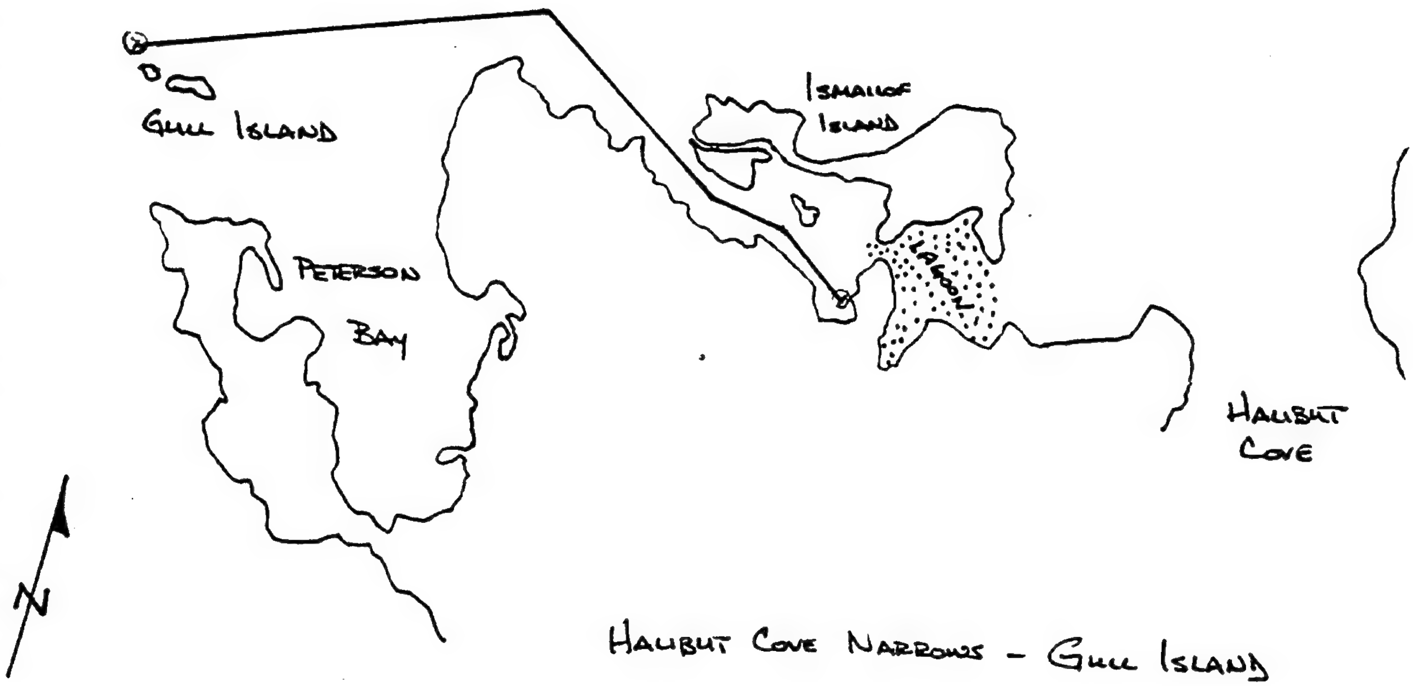
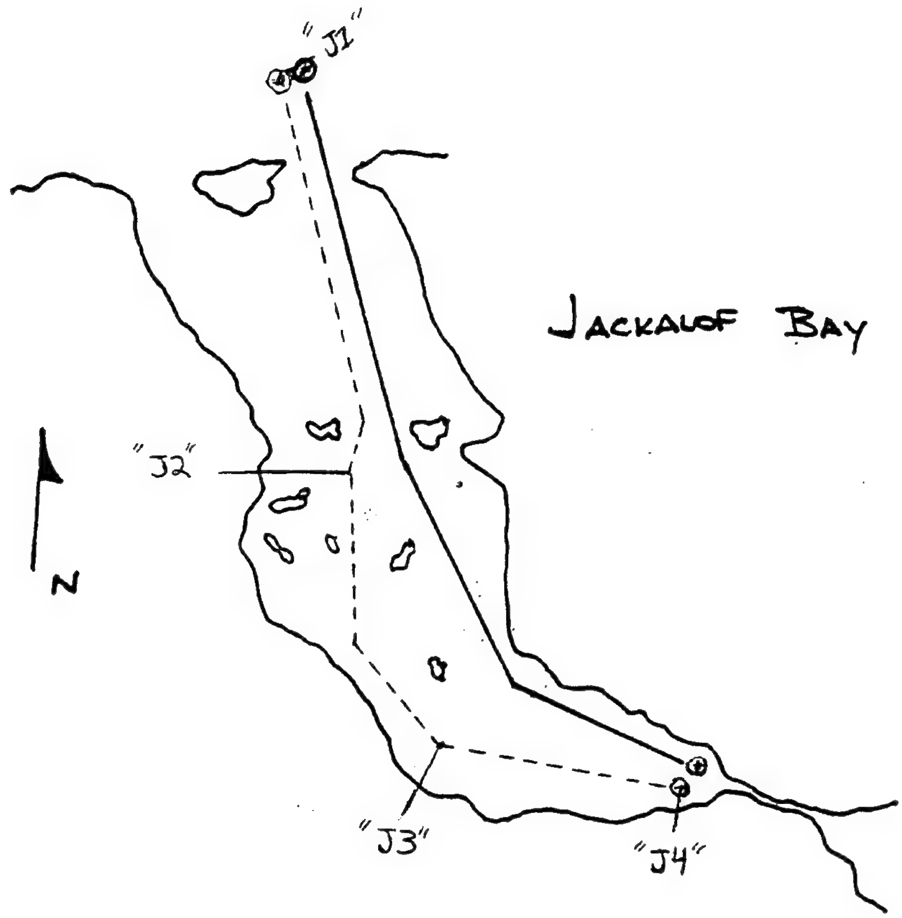


Figure 1.7



Halibut Cove Narrows - Gull Island

Figure 1.8



— NE TRANSECT

-- SW TRANSECT

Zooplankton Net Tows Analysis

by
Shannon Albright
University of Alaska-Fairbanks
Fairbanks, AK

Submitted to

Dr. John Kelley
Institute of Marine Science

University of Alaska- Fairbanks

October 8, 1992

Aknowledgements

I would like to thank Dr. John J. Kelly for the wonderful opportunities that Native students are able to experience. My experiences with the program have pushed me forward in my pursuit of knowledge within marine science. Thanks to George Holmes for dealing with all of us and our differences. Thanks to Dr. Kline for his help with the CTD. I'd also like to thank Dr. Highsmith for letting us cohabitate the Kasitsna Bay Marine Laboratory. Finally, I'd like to thank Russ Gaegel for his patience, help, and guidance.

The main objective of this study was learning techniques in the use of oceanographic sampling and analyzation of data collected. The data therefore is qualitative rather than quantitative.

On July 17th and 18th, 1992 several samples were collected from the Gull Island area, Halibut Cove, Jakolof Bay, and Kasitsna Bay (see diagrams for further information). The samples were collected by horizontal and vertical zooplankton net tows and then bottled and preserved in formalin. The bottles were transported to Fairbanks for examination. Due to time and personnel constraints, only a few of the samples were examined:

Location	Date	Tow	Analyzed
Gull Island	7-17-92	vertical	yes
Gull Island	7-17-92	vertical	yes
Gull Island	7-17-92	horizontal	no
Gull Island	7-17-92	horizontal	no
Halibut Cove	7-17-92	vertical	yes
Halibut Cove	7-17-92	vertical	yes
Halibut Cove	7-17-92	horizontal	no
Halibut Cove	7-17-92	horizontal	no
Jakolof Bay	7-18-92	vertical	yes
Jakolof Bay	7-18-92	vertical	yes
Jakolof Bay	7-18-92	horizontal	yes
Jakolof Bay	7-18-92	horizontal	yes
Jakolof Bay	7-18-92	vertical	no
Jakolof Bay	7-18-92	vertical	no
Kasitsna Bay	7-18-92	vertical	yes
Kasitsna Bay	7-18-92	vertical	no

Analysis of Samples

Gull Island

Taxon	Number	Tow	Detritus
Copepod	58	1 vertical	none
Brachyuran Larvae	2	1 vertical	
Medusae Fragment	1	1 vertical	
Egg Case	3	1 vertical	
Copepod	97	2 vertical	plastic
Bivalve	2	2 vertical	seed pods
Egg Case	2	2 vertical	

Halibut Cove

Taxon	Number	Tow	Detritus
Diptera Wings	2	1 vertical	seed
Bivalve	12	1 vertical	pine needle
Copepod	33	1 vertical	
Amphipod	4	1 vertical	
Diptera	2	1 vertical	
Amphictenidae	2	1 vertical	
Gastropod	3	1 vertical	
Mollusca Shell	1	1 vertical	
Gastropod Shell	2	1 vertical	
Brachyuran Larvae	2	2 vertical	leaf
Amphipod	14	2 vertical	cocoon
Copepod	12	2 vertical	
Sigalionidae	4	2 vertical	
Cumacea	1	2 vertical	
Hydrozoa	4	2 vertical	
Lacunidae	4	2 vertical	
Egg Case	2	2 vertical	
Nematoda	1	2 vertical	
Bivalve	3	2 vertical	
Amphictenidae	2	2 vertical	
Foraminiferida	1	2 vertical	
Polychaete	1	2 vertical	

Jakolof Bay

Taxon	Number	Tow	Detritus
Copepod	47	1 vertical	none
Brachyuran Larvae	10	1 vertical	
Egg Case	6	1 vertical	
Hyperiid	1	1 vertical	
Medusae Fragment	2	1 vertical	
Copepod	84	2 vertical	none
Egg Case	2	2 vertical	
Euphasid	3	2 vertical	
Copepod	1000s	1 horizontal	plastic
Cladocera	100s	1 horizontal	paint chip
Egg Case	56	1 horizontal	

Jakolof Bay cont.

Taxon	Number	Tow	Detritus
Brachyuran Larvae	41	1 horizontal	
Anomuran Larvae	3	1 horizontal	
Diptera	2	1 horizontal	
Paguid Larvae	11	1 horizontal	
Hyperiid	2	1 horizontal	
Bivalve	11	1 horizontal	
Mysid	1	1 horizontal	
Euphasid	2	1 horizontal	
Gastropod	7	1 horizontal	
Egg case	23	2 horizontal	sea grass
Copepod	100s	2 horizontal	
Cladocera	4	2 horizontal	
Brachyuran Larvae	40	2 horizontal	
Arachnida	1	2 horizontal	
Cumacea	3	2 horizontal	
Diptera	5	2 horizontal	
Paguid Larvae	16	2 horizontal	
Medusae Fragment	4	2 horizontal	
Gastropod	32	2 horizontal	
Amphipoda	1	2 horizontal	
Hyperiid	1	2 horizontal	

Kasitsna Bay

Taxon	Number	Tow	Detritus
Euphasid	17	1 vertical	none
Brachyuran Larvae	53	1 vertical	
Copepod	2	1 vertical	
Anthomedusae	1	1 vertical	
Polchaete	1	1 vertical	
Egg Case	2	1 vertical	

KACHEMAK BAY BATHYMETRY

Kevin Van Hatten
David J. Harmon

INTRODUCTION

The utilization of an echogram enabled us to map the seabed of Jakolof, Kasitsna, and Tutka Bays and Halibut Cove within Kachemak Bay. Kachemak Bay was carved by glaciers that covered this area over hundreds of thousands of years ago. Using the echogram we were able to map the effects of retreating glaciers, of the Harding Ice Field.

METHODS

A model FE-881 II echo sounder (fathometer) was used for the sounding and charting procedure. This model is equipped with a recording unit, a transducer, and a battery source (Figure 1). The recording unit was housed within a 2'x 2'x 2' hard case box. This permitted the unit to be used when the seas were unfavorable and kept it from being jarred. The transducer was threaded through a 3' piece of 1" conduit which was attached to the side of a boston whaler. This method kept the transducer attached to the two conductor shielded cabtyre cable when the boat was moving and also allowed a downward directed signal to be sent out and received. We stabilized the 3' conduit by tying the center of a piece of rope to the conduit and running the ends forward and backward. Another piece of rope was tied to the bottom of the conduit,then under the boat and connected to the top of the conduit. This kept the transducer in a horizontal position which allowed for a better signal to be sent out and received. The power source was a 12-volt car battery.

The boat maintained a speed of about 2-3 knots. A speed higher than this would cause the transducer to become unstable or have the transducer ripped off the cabtyre cable from the force of the water.

RESULTS/DISCUSSION

JAKALOF AND TUTKA BAY 7-16-92 partly cloudy, little wind, seas 0-1'
(Figure 2.) 5,380 meter transect

The first transect was from the boat dock in Jakalof bay to Tutka bay via Little Tutka bay. This transect was done to familiarize the group with the fathometer. The beginning of the transect shows a clear terminal moraine at the entrance to Jakalof bay. Once we left Jakalof bay the transducer was removed from the two 2x4's that were used to keep it vertical. This is shown on the map by a flat horizontal line (A on Figure 2). Once we got the transducer stabilized the fathometer worked quite well. One of the main problems with this transect was that when we got to a spot where the seabed dropped off our signal was not being picked up. When this happened we switched the pulse length from short to long.

HALIBUT COVE NARROWS 7-17-92 overcast, ceiling 2,000'
slight wind 6,550 meter transect, seas 1-5'(figure 3.

The second transect was from Halibut Cove Narrows out to Gull Island. This transect shows how the ridges and valleys within the Narrows have sharp contours. As we progressed out farther into Kachemak Bay the sharp contours become more rounded. This might be explained by the fact that there was a larger glacier that formed Kachemak Bay and a much smaller one that formed the Narrows.

JAKALOF BAY 7-18-92 partly cloudy, nowind,seas 0-1'
1. 3,930 meter transect (Figure 4)
2. 4,350 meter transect (Figure 5)

The first transect was from the entrance to the inlet of Jakalof Bay along the North-Eastern side. AT the entrance there is a small island which becomes connected to the mainland at low tide. We wanted to map the entrance to see how prominent the ridge was, but because of the low tide or our limited knowledge of the equipment we did not get a clear signal. There is a kelp bed at the entrance that could have caused the signal to be blocked

causing the record to become unclear (B onFigure 4).

The second transect was from the inlet to the entrance along the South-West side of the bay. The depth was about 5 meters when we started the transect and as the depth decreased our image of the seabed also decreased. We were not able to get a clear signal when the depth was less than 3 meters. By adjusting all the dials we were not able to clear up the image until the boat was in deeper water.

The two transects of Jakalof Bay were done to see how the seabed changed from the Northern side to the Southern side. The Northern side had a constant upward slope with small ridges and valleys, and the Southern side had many prominent ridges and a few deep valleys. This difference was probably caused by the irregular pattern of the glaciers retreat. The topographical map of the area shows the Northern side to have a gentle slope and the southern side to have a more steep slope. The ridge at the entrance was more clear on the second transect than the first. There are a couple of reasons why the ridge was mapped the second time and not the first. On the second transect the captain of the boat went down the main channel, which is void of any kelp. Second when we went through the entrance on the first run the tide was lower than when we went through it on the second run.

KASITSNA BAY 7-18-92 partly cloudy, no wind, seas 0-1'

1. 2,000 meter transect
2. 1,700 meter transect
3. 1,250 meter transect (cross section) Figure 6.

In Kasitsna Bay we did three transects to get a better idea of how the seabed looked. One transect ran from the mouth to the inner end of the Bay, and the second transect ran from the inner end of the bay to the mouth. Our third transect was a cross section of the bay, starting at the outer spit and running across the bay to a point that was designated as the beginning of the bay.

The cross section showed how uneven a glacier's track or retreat is along the bottom.

CONCLUSION

The use of an echogram to map the seabed was of great help to the group in understanding how glaciers shaped the land as they advanced and retreated many thousands of years ago. Being able to take equipment out into the field and be able to get hands-on experience was beneficial to all. At sea experience is a valuable complement to the classroom.

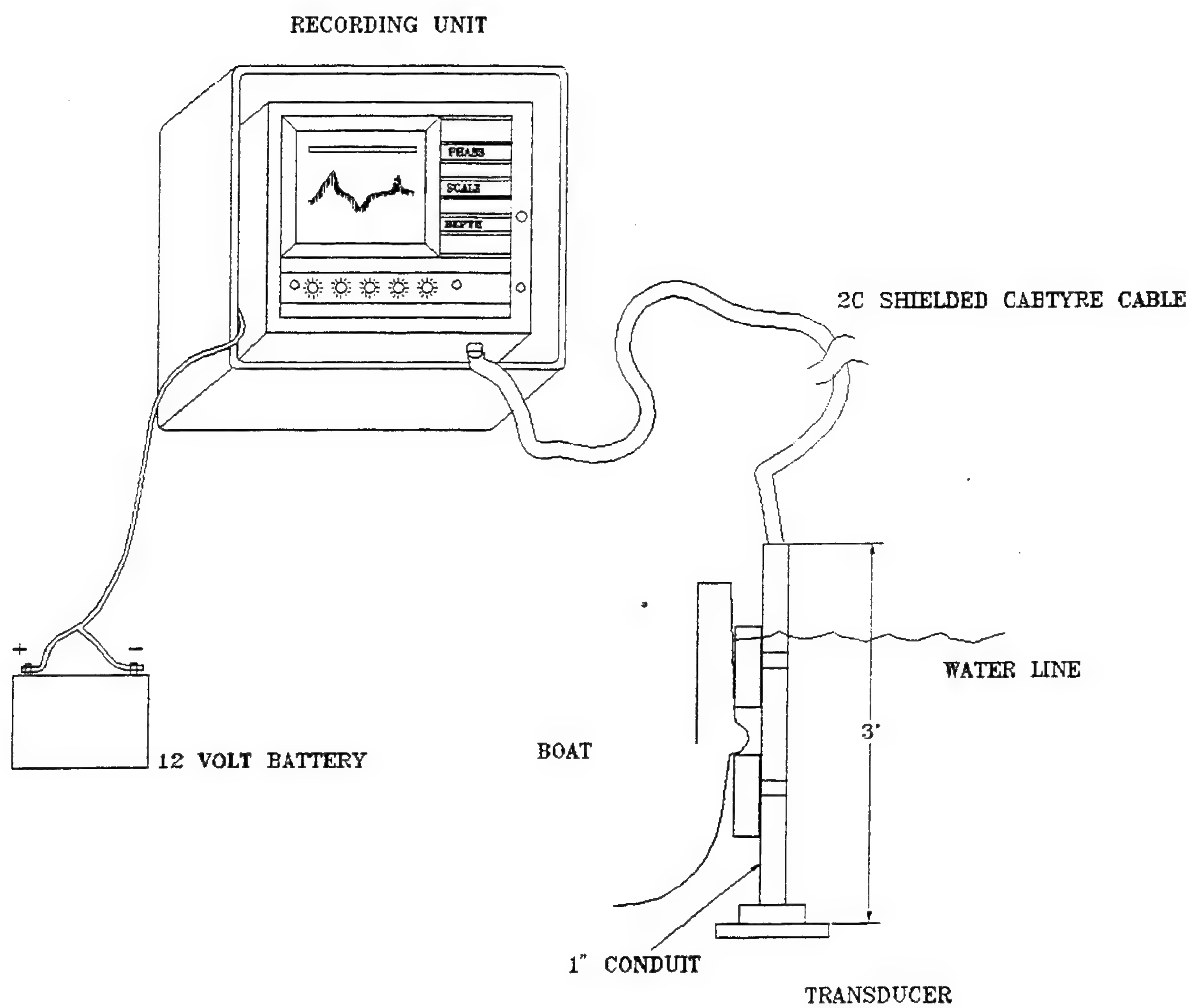


Figure 1. Diagram of Echogram and Connections

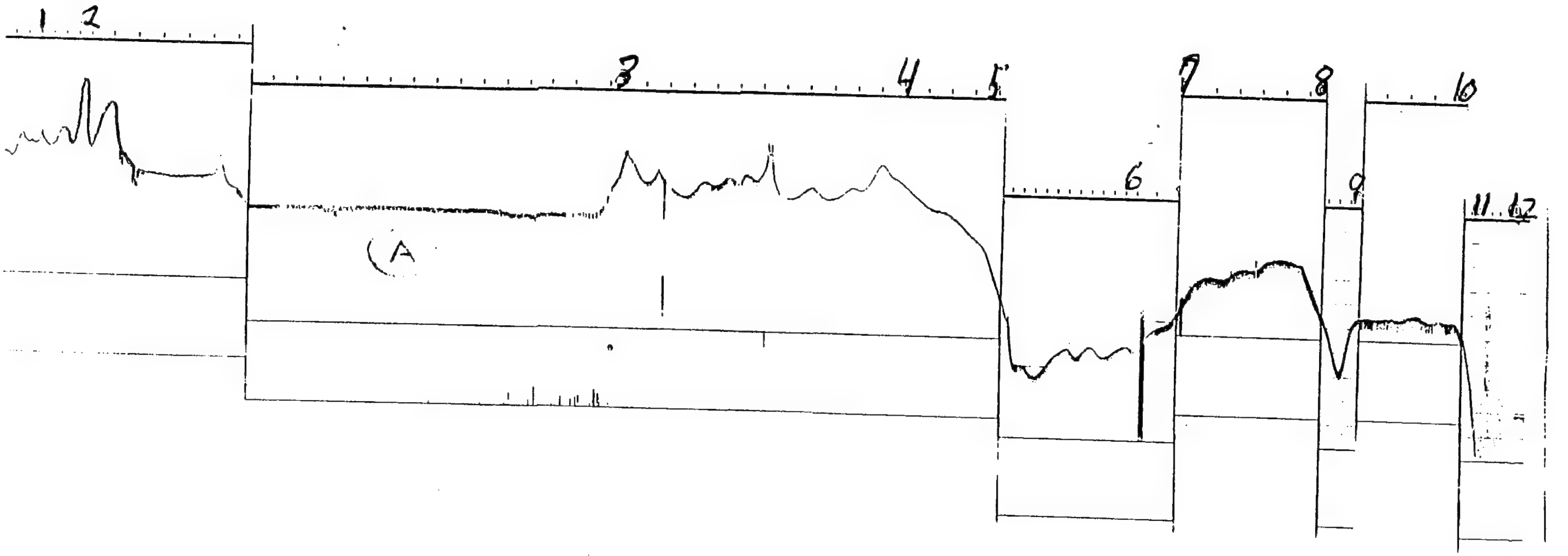


Figure 2. Jakolof and Tutka Bay

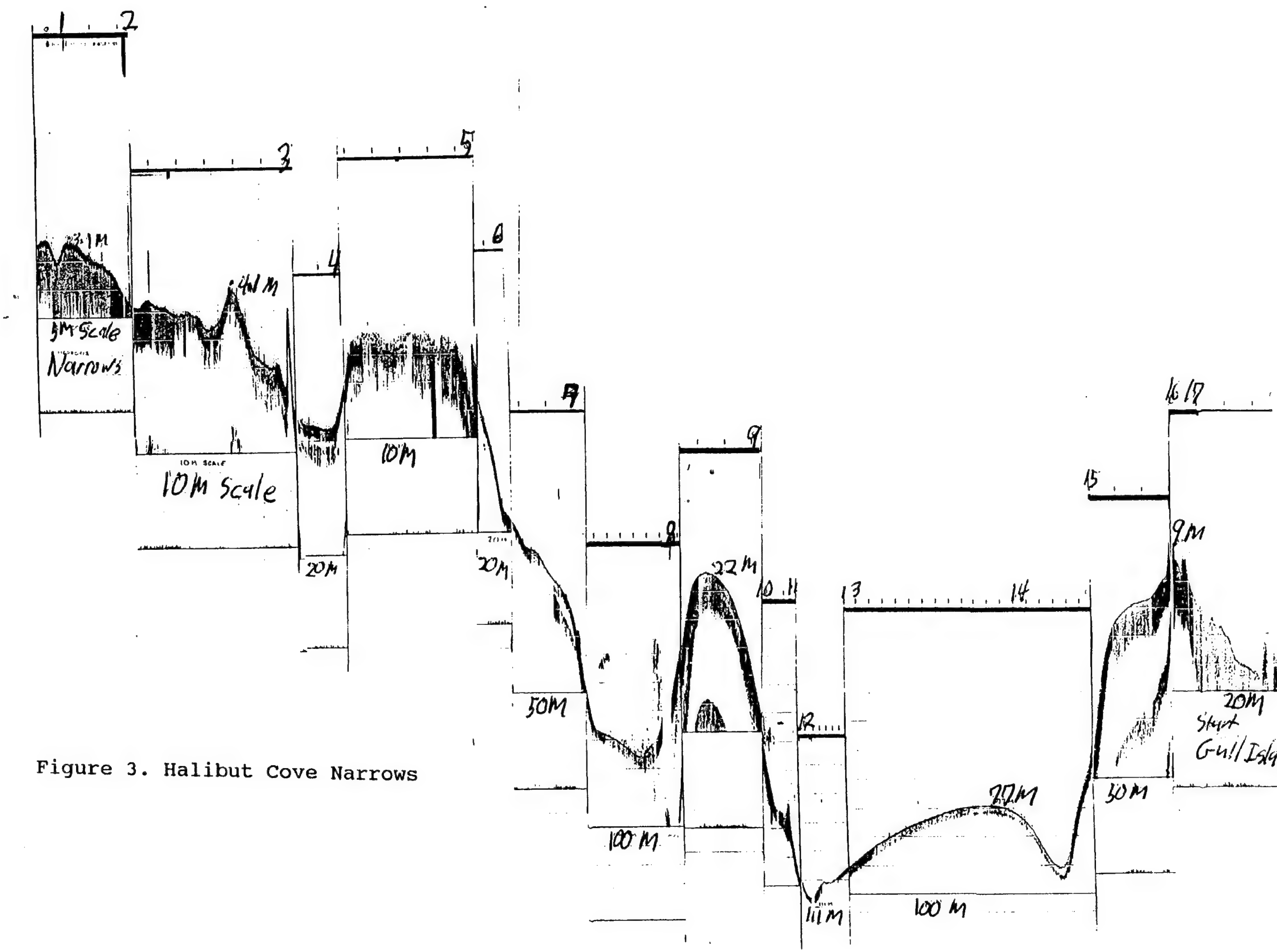


Figure 3. Halibut Cove Narrows

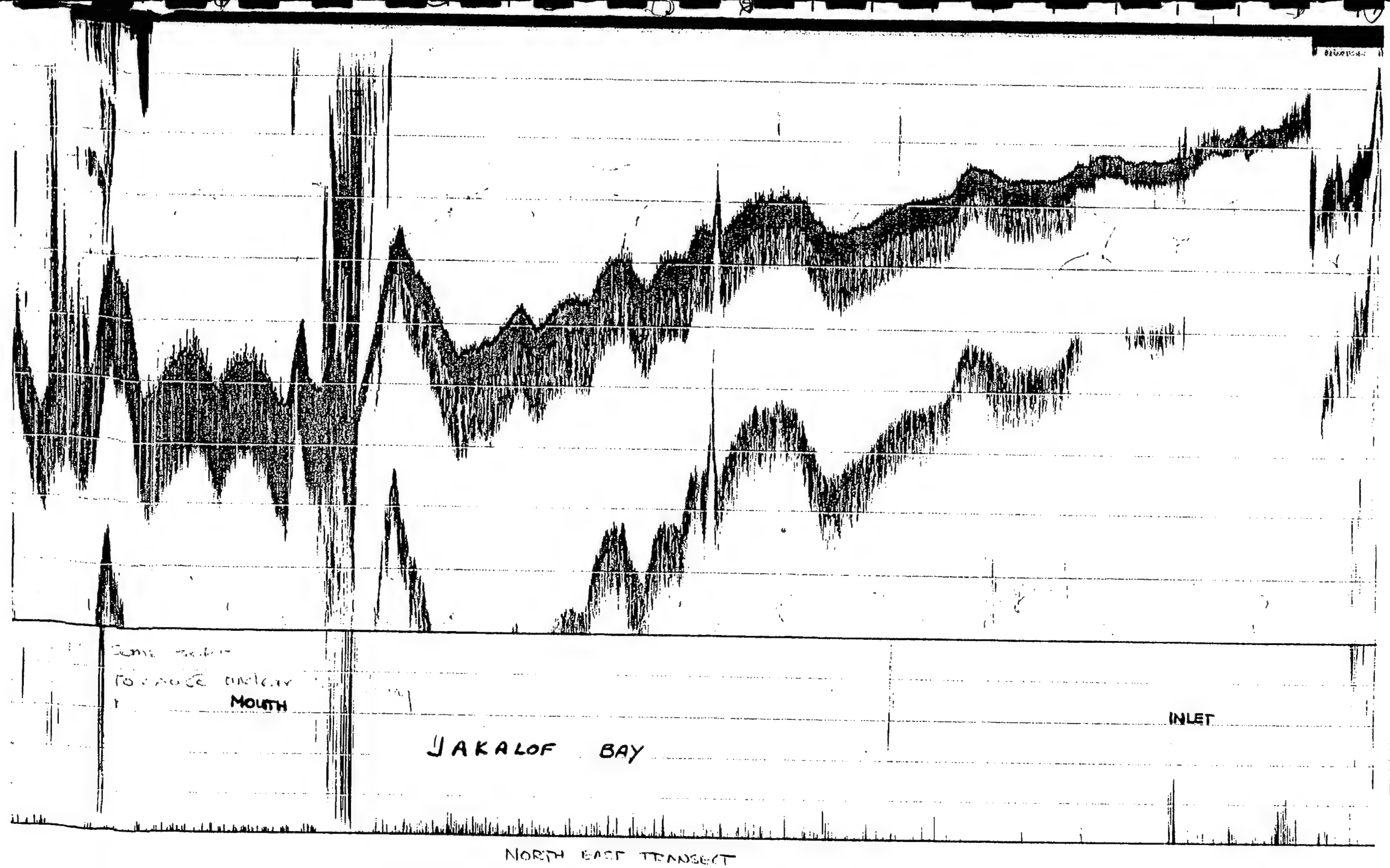


Figure 4. Jakolof Bay Northeast Transect

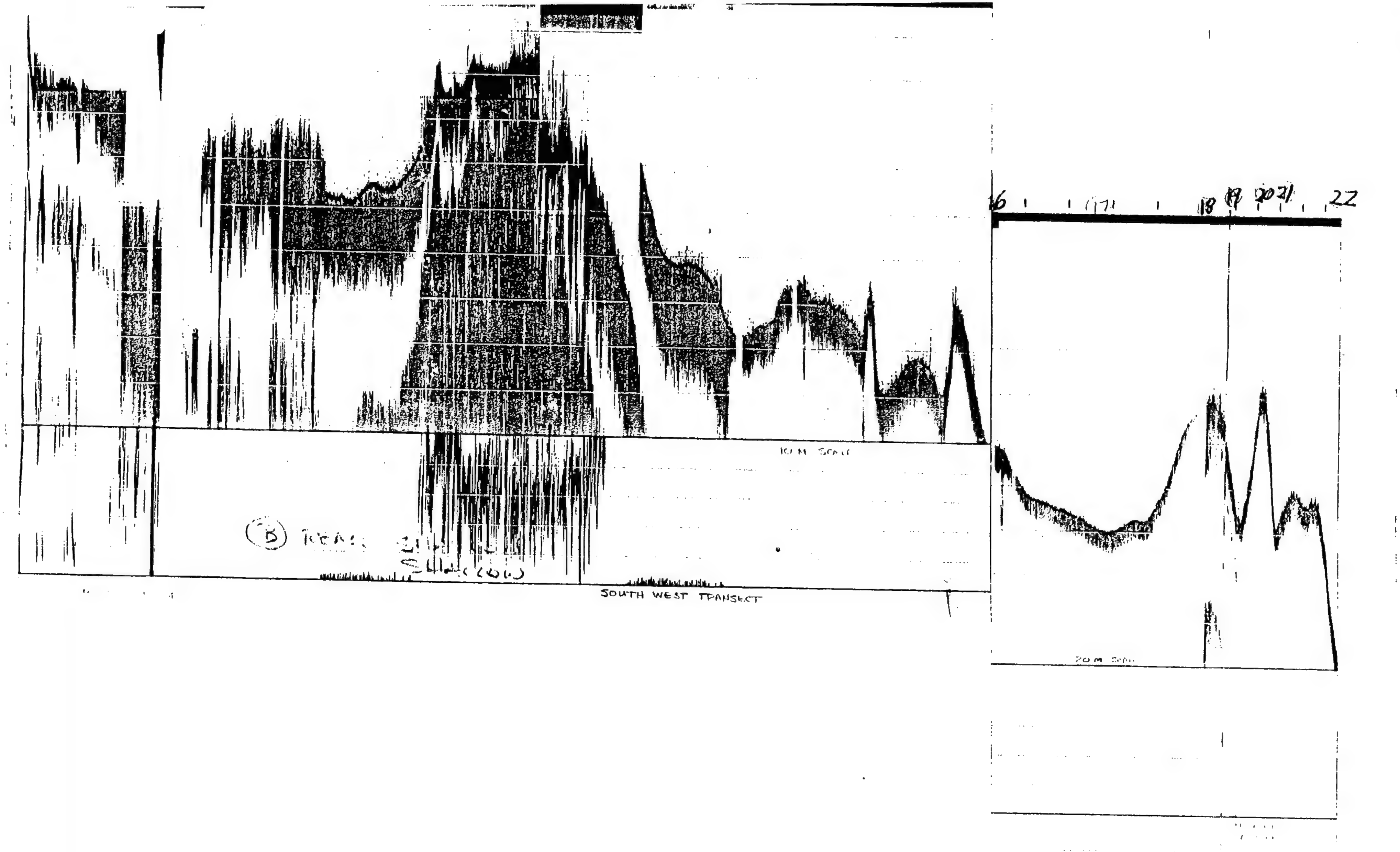


Figure 5. Jakolof Bay Southwest Transect

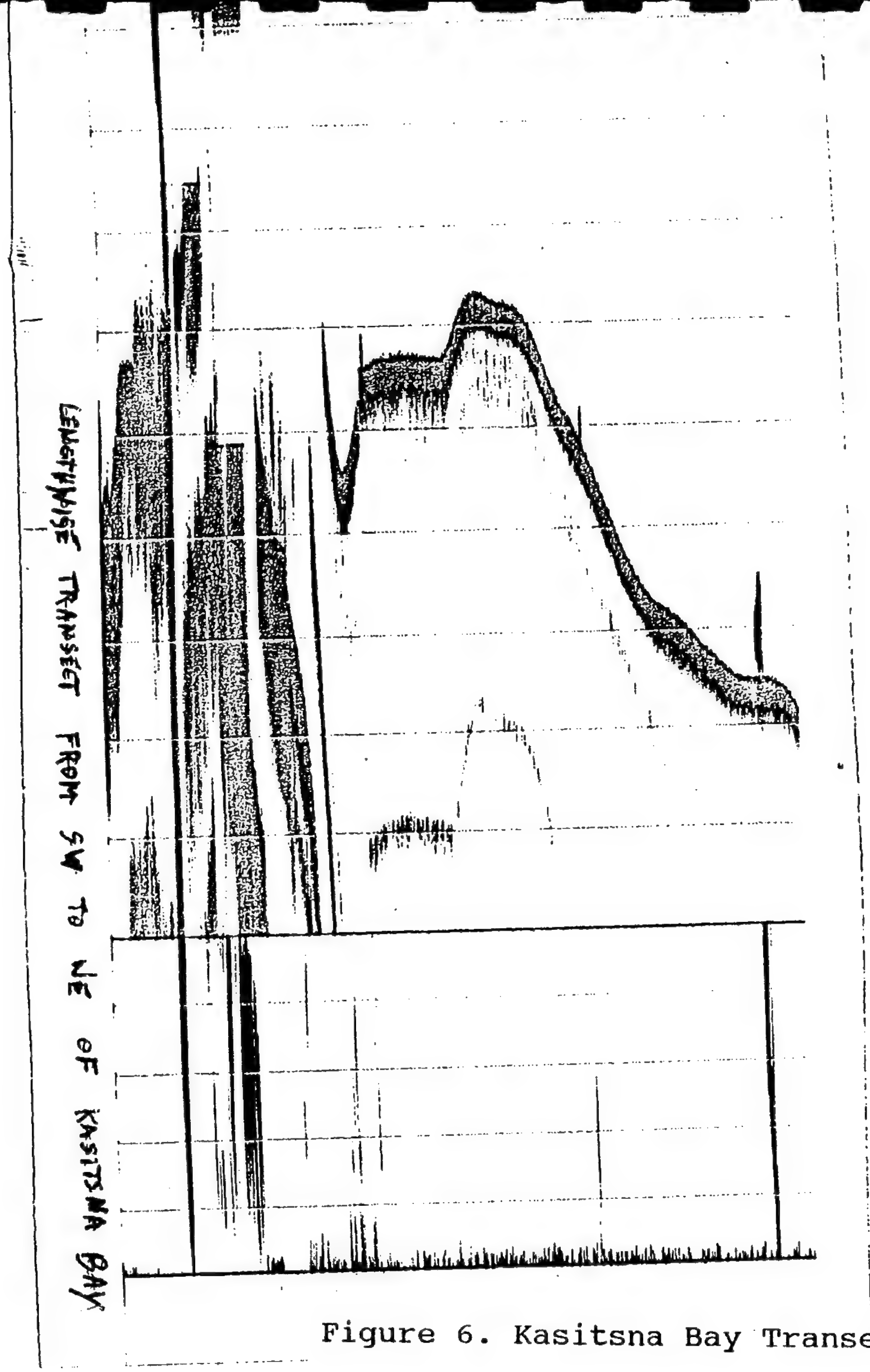


Figure 6. Kasitsna Bay Transect Lengthwise from SW to NE

Freshwater Discharge into Jakolof Bay

David J. Harmon

INTRODUCTION:

Since the discharge of fresh water into a system has a major impact on the biological and physiological aspects of the system it important to take into account these affects. The scope of this study provided one full day for data collection in this area and thus necessitated a study of only one creek. Of the two creeks that discharge into Jakolof Bay, Jakolof creek is by far the major and was therefore the target of our study.

As in all aspects of this study more emphasis was placed on hands-on experience for all team members involved than on precise, quantitative analysis. Within this framework the following is a report on the procedures and findings of the team in the study of freshwater discharge into Jakolof Bay from Jakolof creek.

PROCEDURE:

1.) The team of nine was split into two groups, both charged with coming up with a flow rate for Jakolof creek.

2.) Group one chose a 75 ft.(22.86 meter) section of the creek approximately 1.5 miles upstream of the mouth of the creek.

3.) The section was then divided into five equal sections of 15 ft.(4.57 meters) and marked.

4.) At each of these sections along a transverse line three depth measurements were taken to come up with an average depth along that line.

5.) Stream velocity was measured between each section with the use of a float and stop-watch.

6.) Using $Q = V*A$ a flow rate across each section was calculated where,

Q = stream flow rate,

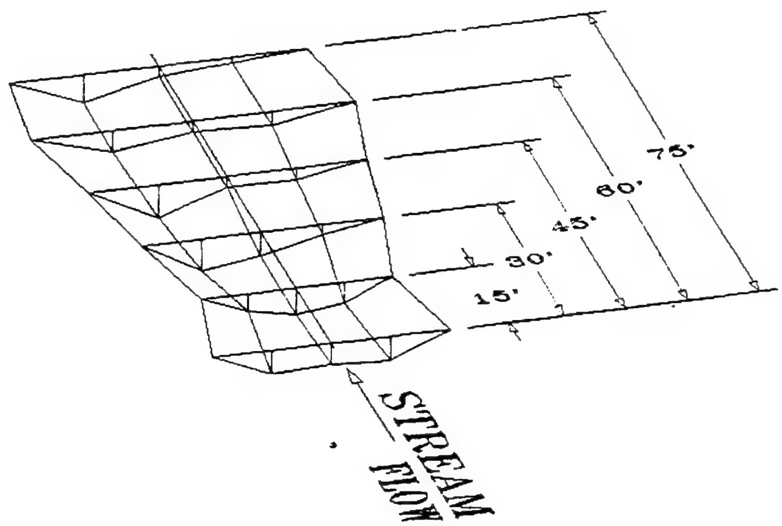
V = stream velocity, and

A = average stream cross-sectional area.

7.) Finally an overall stream velocity, V was taken and used for an average flow rate calculated such that,

Q = V*A.

Streambed contour drawings



GROUP 1

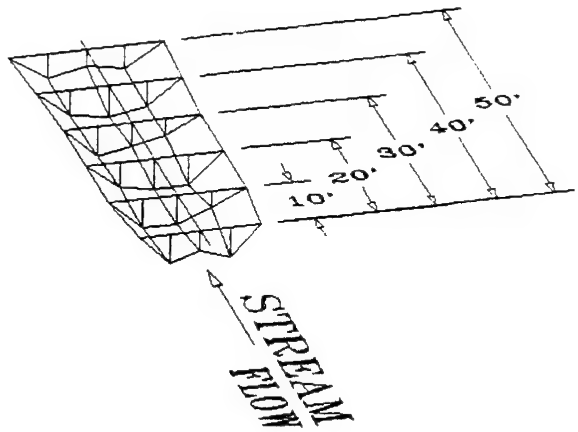
DATA:

The following is a copy of the data collected by group 1.

No.	Depth,(m)	Width,(m)	Area,(m)	Velocity,(m/s)	Q,(m /s)
0.0	0.17	8.36	1.42	-----	-----
4.57	0.16	6.71	1.07	0.47	0.50
9.15	0.16	8.54	1.38	0.53	0.73
13.72	0.13	9.81	1.28	0.44	0.56
18.29	0.11	11.43	1.26	0.45	0.57
22.86	0.20	6.88	1.38	0.56	0.77

V = 0.47 m/s
Q = 0.61 m/s

Group 2 followed the same procedure along a 50 ft (15.24 m) section of the creek approximately 0.5 miles from the mouth of the creek and collected the following data. The section was divided into 10 foot increments.



GROUP 2

NOTE: Stream depth has been scaled up by a factor of 5.

No.	Depth,(m)	Width,(m)	Area,(m)	Velocity,(m/s)	Q,(m/s)
0.0	0.39	4.27	1.66	-----	-----
3.05	0.48	4.88	2.34	0.23	0.55
6.70	0.54	4.88	2.63	0.23	0.62
9.15	0.49	4.88	2.39	0.09	0.22
12.20	0.41	5.18	2.12	0.08	0.18
15.24	0.49	5.49	2.69	0.13	0.35

V = 0.16 m/s
Q = 0.37 m/s

DISCUSSION AND CONCLUSION:

The accuracy of each of the groups final flow rate findings is dependent upon the section chosen for study. A more uniform length of stream, (from cross- section to cross-section), will give a more accurate flow rate. As can be seen from the above data Group 2 chose a significantly more uniform length of stream and therefore came up with a flow rate which is probably more accurate.

A Summer with Enhydra lutris and the Fish and Wildlife Service
by Shannon Albright

During the one week that I was with Marine Mammal Management, Angie Doroff started me off with reading several books and management plans associated with the sea otter. This gave me a better understanding of what the service's policy for sea otters is and what they would like to see happen in the future. I also prepared over 700 sea otter teeth to be aged. This involved listing, arranging, packaging, and getting cost estimates for aging the teeth. I used the Paradox program to make inventory lists, plus to enter data obtained from Gary Matson about teeth he had already aged. An opportunity to see walrus teeth aged luckily coincided during that week. I had hands on experience slicing and then reading the cementum lines associated with yearly growth.

For most of the rest of the summer, I worked at the Fish and Wildlife Research Center. There I worked with Jim Bodkin on sea otter research. Under his direction, I accomplished a literature search and helped to develop the sea otter project's personal library. Furthermore, I read each article in order to get a better understanding of sea otters. In addition, I performed several necropsies on sea otters and practiced sampling techniques of organs for heavy metal, contaminants, and content analysis. The first pre-molars were extracted for aging, too. Besides the research aspect of the job, I attended a small aircraft safety training class in Tok. It was thought at the time that I might help with aerial surveys of sea otters in

Cordova. But, this assignment had to be replaced by a trip to Amchitka because of scheduling discrepancies.

At Amchitka, I worked with Dan Monson. During the two weeks that I was there, I learned how radio-telemetry works and how it is used in order to re-sight animals that have tags and radio transmitters attached to them. If weather permitting, I would hike the coast with radio equipment and a Questar trying to either hear or catch sight of a tagged animal. After a confirmed tag reading, several bits of information were recorded about the animal, such as whether or not a female had a pup or a consort etc. Foraging data was recorded on a mini recorder about the time distribution between diving and eating, how much was eaten, and what was eaten. I, unfortunately, never got the hang of using the Questar, the timer, and the recorder in synchronization with the animal's activity. A sort of rhythm had to be employed that could probably have been attained with more practice.

In conclusion, I would have to say that the training I attained this summer was totally worthwhile. I highly recommend a continuation of this summer experience for others to enjoy and learn from. I believe that my experience would have been furthered if I had a better understanding of the direction I would have liked to gone in the first place. But, like I said, I do not think I would trade the summer of 1993 for anything else.

Acknowledgements

I would first like to thank the National Science Foundation for their support that encourages Native students to pursue careers in the marine sciences. Thanks to, as mentioned, Angie Doroff, Jim Bodkin, and Dan Monson. These wonderful people gave me a direction when I had none. Thanks to George, Dana, Kim, Kelly, Brenda, and Leslie for their help and support. I'd like to also thank everyone else at the Fish and Wildlife Service who helped to make this summer an experience of a lifetime. You all have my utmost respect and friendship always.

Student Internship in Juneau

Robert Hoth
Sept. 8, 1992

Student Internship in Juneau

By Robert Hoth

In the month of August, I worked for the Juneau Center for fisheries and Ocean Sciences. I arrived in Juneau on August 3nd, and left on the 31st. In the time I stayed in Juneau, my overall duties were a lab and labor assistant. I also added computer expertise to help smooth out one experiment.

My daily duties were to work at the Auke Creek Weir, Gastineau Hatchery (DIPAC), and Kowee Creek Hatchery. I would work at one or all of the three work sites depending on the need for extra help. The type of work would vary from counting fish, to taking part with an experiment.

When working at the Auke Creek Weir, I would help count the number of salmon coming through the structure. In the process, I learned how a fish counting weir operates. The task wasn't easy. A person had to decide what species and sex for each salmon. We also look for clipped fins, if found then the salmon would have information extracted from them. Any chinook salmon coming through the weir was killed instantly. This was done so the chinook salmon never have a chance to dominate that certain stream.

The work at DIPAC mostly consisted of feeding the fish and helping with genetic experiments. Some of the experiments were sex-reversed pink salmon gynogens and maximizing gynogen egg survival.

In the sex-reversed gynogen experiment, I learned the

meaning of genetic terms. Some of those terms are: chromosomes, diploid, gynogen, heat shock, ovulation, polar body, and triploid.

The other experiment, maximizing gynogen egg survival, I learned how temperature and days influences the number of surviving gynogen eggs.

Both of these experiments have one common goal. To maximize the number of female salmon fry coming out of the hatchery. This way they will get larger egg returns in the future.

The work done at the Kowee Creek Hatchery was on a temperature experiment. I aided in the preparations, and doing the experiment in the early and latter part of the month, respectively. The purpose of the experiment is to find out how temperature effects the early and late runs. In this experiment, I used some of my computer skills to produce basket maps for the incubator trays. These maps helped organize and accelerate the experiment. I learned what preparatory measures are needed before such an experiment can get under way.

In conclusion, I learned a massive amount of material during my stay in Juneau. I hope I can turn around and use that material to further advance, with direct relation to computers, the field of Fisheries and Ocean Sciences.

OBSERVING METHANE VENTS OFF THE OREGON COAST

BY

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A FIELD RESEARCH REPORT

JANUARY 1993

OBSERVING METHANE VENTS OFF THE OREGON COAST

INTRODUCTION

All biological life depends on the production of energy, whether it is generated via photosynthesis or chemosynthesis. The many organisms that derive their energy from photosynthesis utilize the solar radiation emitted from the sun. Among these photosynthetic organisms are ones that live in habitats where light is a limiting resource. When light is the limiting resource the organisms that are being affected replace light energy for chemical energy in the synthesis process for fixing organic compounds from inorganic compounds (Tunnicliffe 92). Some of the many different habitats where this type of substitution occurs are located deep under water or in caves. The marine environment contains a vast amount of living organisms, but only a very few rely on light for obtaining their energy.

There are many different forces of nature that act upon the earth. Of the many different forces, the major one is, the one that acts upon the earth's crust. Where new pieces of land are being formed and old pieces of land are being destroyed. This force constitutes the main energy for producing some of the gases that is expelled through vents in the sea floor. These vents are known as "Hydrothermal Vents" which have been commonly associated with the spreading of tectonic plates along mid-oceanic ridges. This phenomenon is part of a cyclic process that causes both destruction and creation of the earth's crust (Tunnicliffe 92). The formation of Hydrothermal vents occur when cold dense sea water

"leaks" into the sea-floor where it then becomes heated by hot magma, underlying the crust. The hot magma catalyzes the sulfate, in the water, to sulfide which along with many minerals, are leached out from the rocks. The sulfide and minerals combined are pushed upward through a rift valley producing the vents (Tunnicliffe 92) (Fig 1). The vast mid-oceanic ridge, which bisects the four major oceans, contain many vents that are being studied by scientists (Fig. 2).

Along this vast ridge lies the Juan de Fuca Ridge, where a group of biologist, geologist, and geochemists have been studying active methane vents. This study is headed by Dr. Robert W. Collier of Oregon State University, with other Co-principal investigators including M. Lilley from the University of Washington, G.L. Taghon of Rutgers, and D. Stern of the National Undersea Research program (NURP). With help from Dr. Waldo Wakefield and Dr. Ray Highsmith, who both work for NURP, I was invited to accompany the scientists on a five day cruise along the Oregon coast, to get hands on experience with some of the equipment that was being used.

The site of the study is 43 degrees 01.91 minutes North and 124 degrees 39.84 minutes West. This area is approximately 25 miles South West of Coos Bay, Oregon. A 113 foot boat the R/V JOLLY ROGER was used as the primary lab and living quarters for the seven scientists and crew members (Appendix, photograph 1.) The submersible DELTA was used to make 27 dives over the five day study (Appendix, photograph 2).

During the five day period the group accomplished many different tasks, with the primary objective being to try to get as many core samples as possible from around the *Pockmark*.. A Pockmark is a erosive feature that is found on the sea-bed which records the recent activity of fluid seepage through the sediments

FIG. 1: The formation of Hydrothermal vents

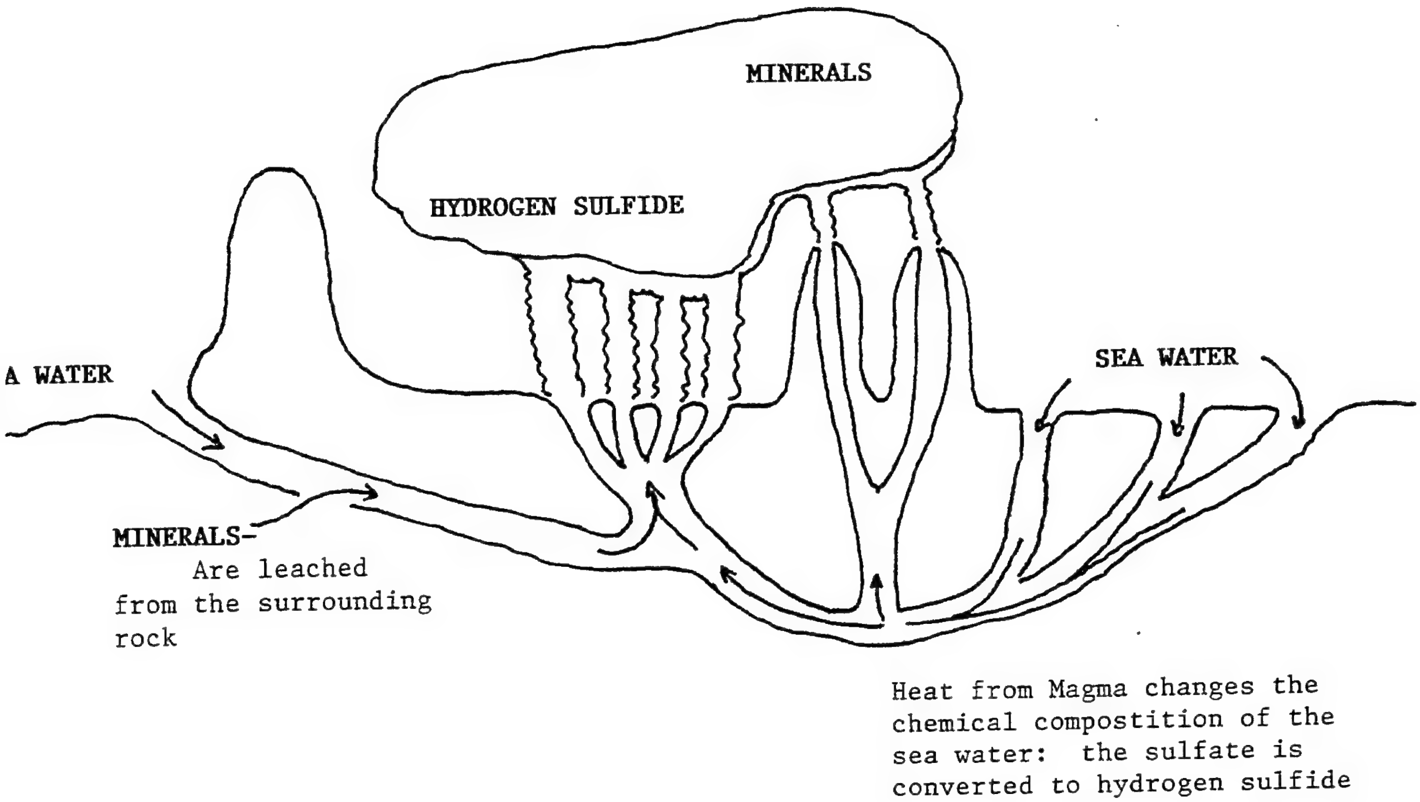
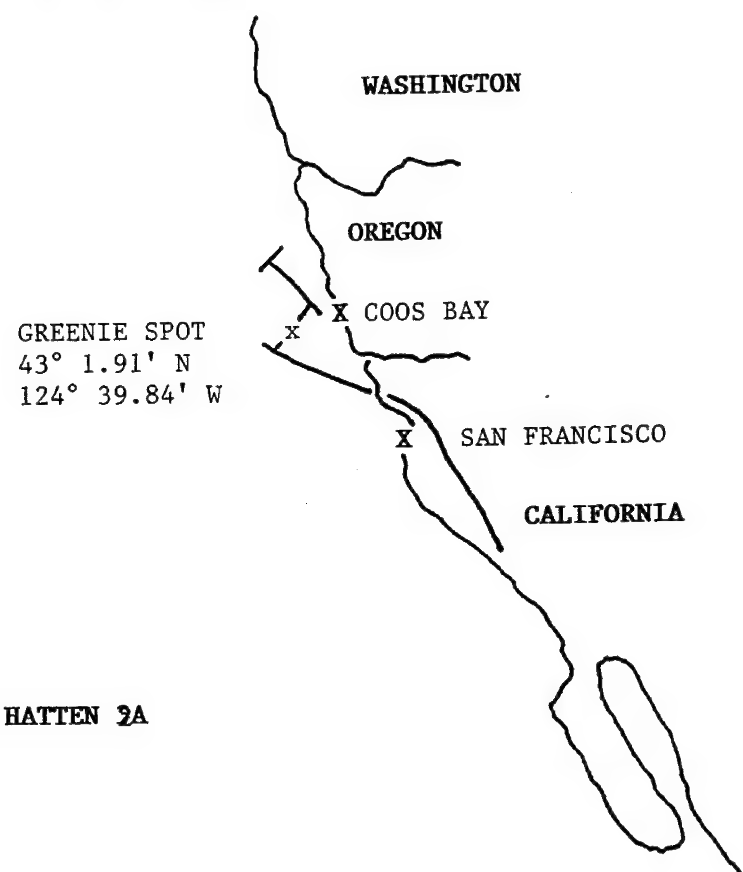


FIG. 2: The Greenie Spot on the Juan de Fuca Ridge



(Collier 92). During past studies the weather was too bad to allow the submersible to make any dives and collect sediment samples.

MATERIALS AND METHODS

One of the pieces of equipment that was used was a Box Core (Appendix, photograph 3). This was used to retrieve core sediment samples from around the vent site. Using a specialized housing, the box core could be attached to the submersible. The box core was hooked onto the submersible by a pin, and by reeling in some rope the sub pilot could deploy the box core. After repeated dives, dive 2915 and 2916, the box core had to be replaced because of a malfunction in the tripping device to close the box. When the pilot would release the box core, it would trip itself and close shut before hitting the substrate. The backup for taking sediment samples was a gravity piston core (Appendix, photograph 4). Some modifications had to be done to the housing to allow the piston core to be attached. The gravity core is a four foot iron tube with four two foot wings on the back. There was a plastic tube, that is of a smaller diameter than the piston core, that was inserted into the core, this was done to collect sediment samples from around the vent.(Appendix , photograph 5).

On several of the dives (dive 2919 and 2931) we went down and took temperature readings, of the sediments and the overlying water around the pockmark. The temperature probe was attached to the submersibles arm with electrical tape, and the cord was fed into one of the outlets on the submersible to record the data (Appendix, photograph 6).

Three of the dives, dive 2918 , 2930, and 2935, were used to go down and collected samples of bacteria that were growing in mats around the vent site. This was accomplished by attaching a slurp gun to the arm and hooking up a tube to the vacuum on the submersible (Appendix, photograph 7).

On dive 2918 we attached a gas sampler to try to catch some of the gas escaping from the vents (Appendix, photograph 8). The samples were then put in the reefer (refrigerator unit) to be stored until they could be analyzed at Oregon State University.

I was asked, by Dr. Marv Lilley, to accompany the sub-pilot down, on three of the dives: dives 2920, 2933, and 2939. The very first dive (2920) was very remarkable for me because, this was the first time that I was able to go underwater to a depth of about 400 feet. The submersible is not very big, it is about 15 feet long and about 10 feet high and about 4 feet wide. When I got in the submersible I had to lay on my stomach with my face pointed towards the windows. There are five windows that are used for observing the under water surroundings. Between the outer windows and the inside of the submersible there is a space that is used as a balancer to either lift the submersible or allow it to sink. There is also one in the back of the submersible. As these "balancers" filled with water the submersible started to sink below the water line. As we sank down farther and farther the amount of light that was able to penetrate the water got weaker and weaker, until finally the sub-pilot turned on the lights. At about 250 or 300 feet down we drifted through a layer of juvenile Euphausids. This was pretty exciting because all the small organisms were attracted to the powerful search light.

Being on the bottom of the sea floor was fascinating. It was almost like looking into a fish tank at the local pet store. The only difference is that these organisms were not contained in a 6 by 6 holding tank. As we moved along, just

above the substrate, the sub-pilot was in constant contact with the bridge asking for directions for the pockmark. I was in my own little world, looking and observing what happens on a daily basis down on the bottom of the sea. I have seen marine fish, shrimp, and plants but that was either in the store or looking down through the water. Here I was able to look at them "face to face".

After we finally found the Pockmark we sat at the edge waiting and observing the sights and sounds the vent was making. As we sat on the sill of the vent there I noticed many stripped shrimp sitting in crevasses and along some of the ledges. We then deployed the piston core and started the ascent back to the surface.

ACKNOWLEDGMENTS

This trip was one of those experiences that was well worth the time and effort put into it by the many people who made it happen. I am greatly appreciative to these people particularly Drs. Waldo Wakefield and Ray Highsmith (NURP) and Drs. John Kelly and Vera Alexander (Institute of Marine Science -IMS).

I particularly acknowledge support provided by the National Science Foundation (Ocean Science Division) and the United States Navy, Office of Naval Research (Arctic Branch) through their intern programs in marine science for Alaska Native College students.

ITINERARY FOR SUBMERSIBLE <u>"DELTA"</u>

DIVE #	CREW	OBJECTIVE
2914	MARV/DAVE	Reconnaissance, put down transponder
2915	MARV/DAVE	Put down flasher, deploy box core
2916	PETE/DON	Deploy box core
2917	ANDY/DAVE	Deploy piston core
2918	GARY/DAVE	Collect gas samples
2919	GARY/CHRIS	Slurp gun sample
2920	MEL/DON	Temperature of substrate and water
2921	KEVIN/DAVE	Deploy piston core
2922	MEL/CHRIS	Picked up transponder
2923	ERIC/DAVE	Deploy piston core
2924	MARV/CHRIS	Picked up flasher
2925	PETE/DON	Deploy flasher and piston core
2926	GARY/DAVE	deploy piston core
2927	Picked up flasher	
2928	PETE/DON	Deploy piston core (fell off at surface)
2929	PETE/DAVE	Hunt for piston core, retrieved
2930	MARV/CHRIS	Deploy piston core (good one)
2931	MARV/DON	Slurp gun sample
2932	MARV/DAVE	Temperature reading
2933	GARY/CHRIS	Deploy piston core on North side od Pockmark
2934	KEVIN/DON	Down through bubbles, deploy piston core
2935	PETE/DAVE	Deploy piston core
2936	ERIC/CHRIS	Slurp gun sample
2937	PETE/DON	Deploy piston core
2938	MARV/DAVE	Slurp gun sample
2939	PETE/CHRIS	Deploy box core
2940	KEVIN/DON	Picked up transponder

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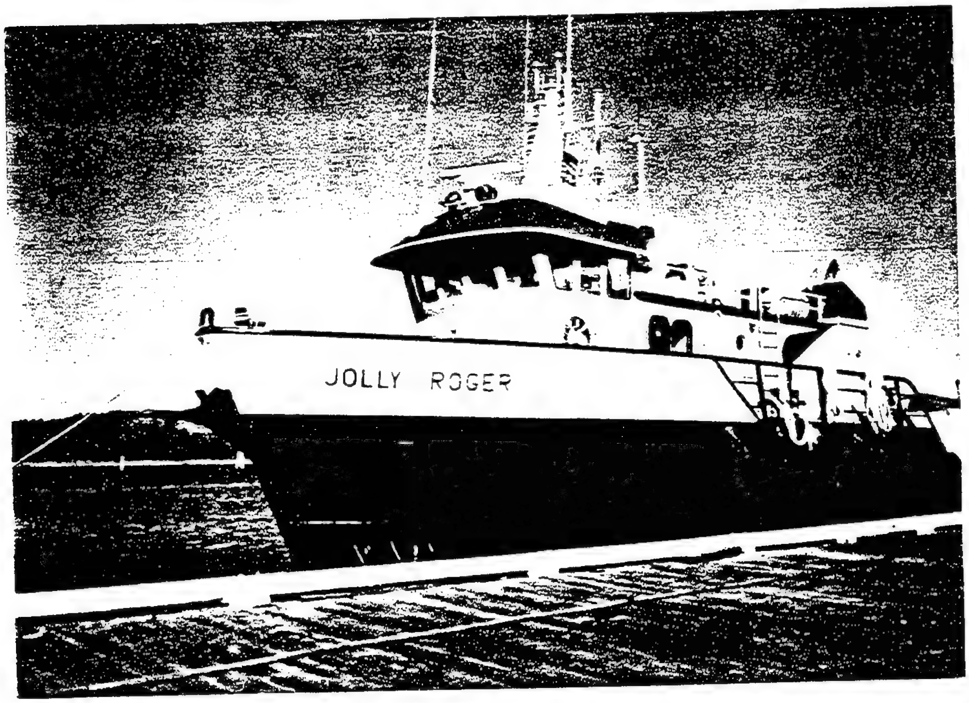
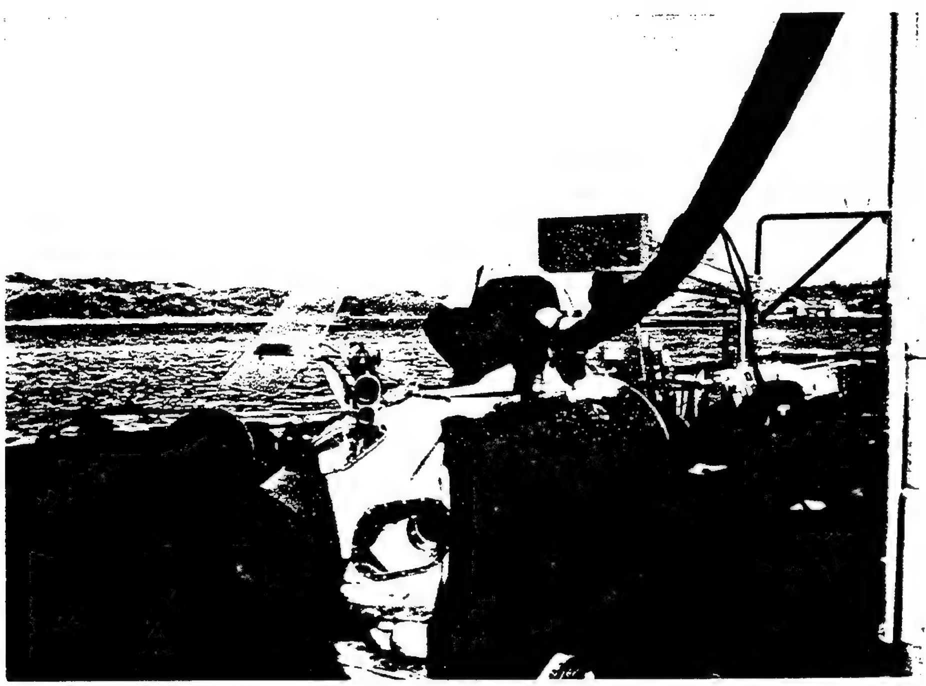
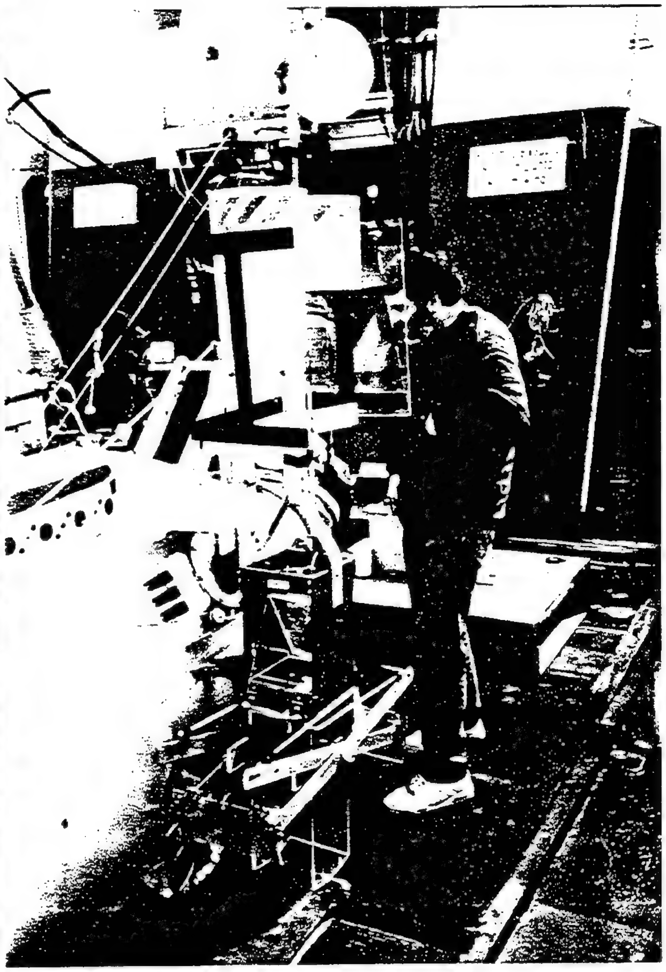
A P P E N D I X



PHOTOGRAPH 1: R/V JOLLY ROGER



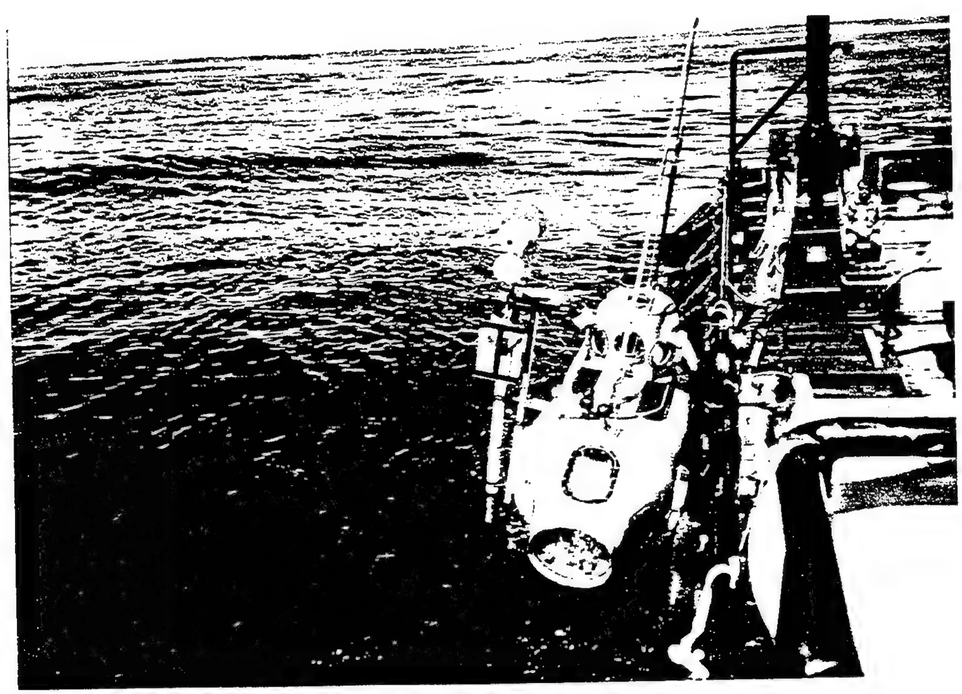
PHOTOGRAPH 2: SUBMERSIBLE DELTA



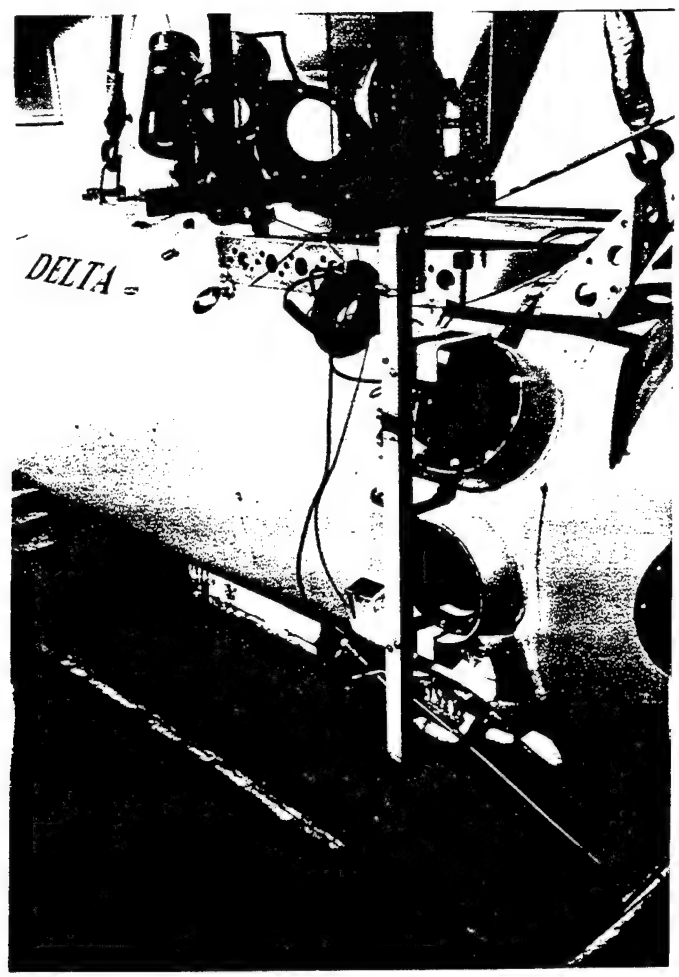
PHOTOGRAPH 3: BOX CORE ASSEMBLY

PHOTOGRAPH 4: PISTON

GRAVITY CORE



PHOTOGRAPH 5: PLASTIC INSERT WITH SEDIMENT SAMPLE



PHOTOGRAPH 6: TEMPERATURE PROBE ASSEMBLY

PHOTOGRAPH 7: SLURP GUN ASSEMBLY

PHOTOGRAPH 8: GAS SAMPLE ASSEMBLY

CRANIAL AND DENTAL ANOMALIES OF THE ALASKAN SEA OTTER
(*Enhydra lutris kenyoni*)

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INTRODUCTION

There has been minimal cranial and dental research done specifically on the sea otter subspecies *Enhydra lutris kenyoni* . Most work done on carnivors has isolated incidents of anomolies occuring in very low or unreported sample sizes. (Fisher, 1941) (Heran, 1970)(Kenyon, 1975)(Bjotvedt and Turner, 1976)(Estes, 1980)(Wolsan, 1984)(Tumlison and Wilhide, et al. 1985) Substantial sample sizes have been found but not for this specific subspecies or covering a broad range. (Beaver and Feldhamer,et al., 1981)(Addison and Strickland, et al., 1988)

In this paper we would like to determine the frequency of alveolar thinning, congenital agenesis, irregular placement, supernumerary teeth, rotation, worn dentition, caries, plagiocephaly, bregmatic bones, heterotopic bones, exostosis, and porous bone, anamolies for this population and get a better understanding of how much is occuring. Examination of the dental condition of this species will give a veiw of the overall health and fitness of the population and allow us a closer look at the influence of genes in this population.(Beaver and Feldhamer, et al., 1981). Such information may allow the sea otter to serve as a model for human populations.(Henrichsen, 1980)

MATERIALS AND METHODS

On February 27, 1993 we traveled to the University of Alaska Museum (UAM), Fairbanks, Alaska, to examine their collection of sea otter skulls. We

examined a total of 210 skulls collected in the area around Hinchinbrook Is. Alaska, all along the south coast of Alaska down to Adak Island on the Aluetians.

Specimens were rotated and throughly examined by hand, inside and out, at the skull and mandibles. Recorded under the UAM number was the sex, locality collected, broken or missing sections of skull, and a precise description of defects. Each skull was inspected for : 1) alveolar thinning - exposure of buccal roots, 2) congenital agenesis - reduced dental complement due to teeth that failed to develop, 3) irregular placement - teeth in positions other than the normal pattern, 4) supernumerary teeth - those in excess of the normal dental pattern, 5) worn dentition - crown erosion to gum line, 6) caries - decay of dental tissue, 7) plagiocephaly - asymmetrical cranial growth due to premature closure of one frontal-parietal suture, 8) bregmatic bones - extra bones derived from accessory ossification, 9) heterotopic bones - small accessory bones, 10) exostosis, and 11) porous bone - erosion of bone to form many small pinholes.(Beaver and Feldhamer , et al.,1981)

A noticable bulging perforation and visible discoloration at the post-orbital constriction and on frontal bones was also regarded. This irregularity was recorded as a Skrjabingylus nematode infection. Discoloration and swelling of frontal bones could possibly be from incomplete removal of soft tissues and a normal apathogenic process, but they were considered Skrjabingylus infections for the consistancy in lesions of prior work.(Addison, Strickland, et al., 1987).

A typical dentition formula for sea otters is :

I C PM M

$$\frac{3}{2}\,\frac{1}{1}\,\frac{3}{3}\,\frac{1}{2} \times 2 = 32$$ (Bjotvedt, Turner, 1976)

When teeth had fallen out during preparation and curation of the skull alveoli were counted and added to the number of teeth. In this manner congenital agenisis could be properly evaluated. Other unusual occurances were noted.

RESULTS AND DISCUSSION

A total of 184 skulls (88.9%) had at least one anomaly, or other form of deformation. This is greater than the river otter (*Lutra canadensis*) which had anomalies occuring at 32.3%.(Beaver and Feldhamer , et al.,1981)

Alveolar thinning was the most predominant dental anomaly found. A total of 123 skulls (61.9%) had alveolar thinning. Most was found on the dorsal surface of molar one. Previous work on river otters has alveolar thinning associated with the upper premolars.(Beaver and Feldhamer , et al.,1981)

Congenital agenesis was found in 4 skulls (2.05%). This anomaly was mainly found on the upper premolars 1,2, and 3. Due to lack of equipment x-rays were not taken to see if there were teeth present that failed to erupt.(Beaver and Feldhamer , et al.,1981) Viewing the skulls by hand we noted 1 skull with teeth that failed to erupt, and one that had impacted teeth.

Worn dentition was found in 19 skulls (9.95%). The occurance of this anomaly was found mainly on the upper/lower premolar two and three, and molar three.

Caries were found in 1 skull (.523%) Previous studies show a low occurance of caries in otters. (Hooper and Ostenson, 1949) This low occurance i s not yet understood.(Beaver and Feldhamer , et al.,1981)

Of the cranial anomalies plagiocephaly was the most predominant anomaly shown. It occured in 28 skulls (14.5%) Previous work shows that this

anomaly may be connected to injury or Skjabinglys infection. (Beaver and Feldhamer , et al.,1981) Skajabinglys infections occurred in 13 skulls (6.77%).

Exostosis was found in 18 skulls.(8.87%), porous bone 18 skulls(8.87%).

In our report the sea otter _E..l.. kenyoni s_ is exhibiting a high frequency of dental and cranial anomalies. The history of the sea otter shows heavy hunting and low population numbers. These two causes may be showning an effect on the sea otter in the visible high frequency of anomalies.

Dental and cranial anomalies are indicators of malnutrition or poor health within a population. (Hooper and Ostenson, 1949). It could be that the sea otter does not have an adequate diet or the difference in food sources for areas is variable.

It was noticed that sea otters furthur out towards the Aluetians had more pitting occuring in teeth than did sea otters located in Prince William Sound area. Statistical data representing this was not available at this time.

ACKNOWLEDGEMENTS

I would like to thank Joe Cook, mammal curater at the University of Alaska Museum for allowing us use of their otter skulls, and K.B. Schneider for his generous donations to the UAM otter skull collection.

I would also like to thank David Williams and admistrative staff at the Kuskokwim Campus in Bethel for providing funding for transportation and per diem.

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SUMMER STUDY OF BLACK BRANT AT THE TUTAKOKE RIVER COLONY, YUKON-KUSKOKWIM DELTA

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A Field Research Report

November 23, 1992

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INTRODUCTION

Black Brant (*Branta bernicla nigricans*) are marine geese that breed on the northern and western coasts of Alaska and Canada and winter on the coasts of British Columbia, Washington, Oregon, California, and Mexico. The populations of these birds have slowly been declining for the past few decades. Research in progress on the western Alaska coast at the Tutakoke river colony is looking at factors that may affect population numbers of Black brant, in order to find ways to adequately manage the populations.

Black Brant were marked and observed with individually alpha-numerically coded tarsal bands during the years 1986-1992, at the Tutakoke River colony. Observations and recaptures of banded birds looked at dispersal of birds to different colonies, survival rate, and nest/brood site fidelity. Data is being collected to study nest and brood site fidelity, survival rates, and dispersal of males and females (Lindberg & Sedinger, 1992).

STUDY AREA

The Tutakoke river study area is located about 1/2 km from the shoreline of the Bering Sea (Fig. 1). It is a very flat, low lying (elevation 1-8 m) tidal region with

numerous rivers, sloughs, brackish shallow ponds and lakes (<5 m). Flood tides commonly occur in the autumn causing ponds to be brackish, and low lying mudflats are submerged by tides of which the average is 3 m (Fig. 2). The nearest freshwater pond is approximately 12 km inland.

Vegetation is short (< 1/2 m) throughout the year. Vegetation present are: Carex ramenskii, Potentilla egedii, Stellaria huminfusa, Poa eminens , Puccinelia phryganodes, and Carex subspathacea (Kincheloe & Stehn, 1991). These species are predominantly fed on and important for nesting areas.

METHODS

For the studies done on the Tutakoke river, individually coded color tarsal bands were the major instrument used for identification of previously banded birds. Age, sex and banding site can be obtained from band records.

To look at colony formation, random circular 50 meter radius plots throughout the colony were marked and visited every 4 days from nesting initiation to the end of egg laying. Nests on each plot were marked with a nest stake showing the plot number, nest number, and band codes if adults were banded(Fig. 3). Eggs in each nest were marked with the corresponding nest number, and or plot number, and series in which eggs were laid. Data concerning nest location (mapping), nest lining, number of eggs laid, new eggs, egg measurements, and number of eggs preyed on were recorded (Fig. 4). Nests in which the adults had tarsal bands were noted and visited later during hatch.

Concentrated nest searching was done to find banded adults. Once found the nests and eggs were marked and numbered in much the same way the plot nests were marked. At the time of hatch all known banded adult nests were visited daily and eggs were checked for hatching. Condition of all eggs in nest were recorded and web tags were placed on the foot of all hatched goslings or goslings in pipped eggs. Numbers of the metal web tag were recorded along with the number series of the egg the gosling

came from, if it was known. If it was possible to web tag all goslings at a given time colored bandets were put on. Colors of bandets corresponded to the number of goslings in the nest. Bandets were placed on goslings to look at adoption rate among broods.

After hatch, time was spent in various towers situated in areas where there was ample movement of broods to feeding areas. Towers were elevated 3-5 m off the ground and were covered with blinds (Fig. 5). From the towers all visible bands were read with questar telescopes. Number of goslings in broods of banded adults were recorded, along with information on colored bandets. To provide ample study time during mass movements of birds without disturbance, tower stints were 48 hours long. During this period timed observations were taken noting, vegetation being fed on, number of broods spotted, and hour long activity budgets of a select brood with banded adults.

Two nearest neighbor distances were recorded for each plot nest to evaluate the density and distribution of nesting throughout the colony. Two to three people walked the plots finding each nest and if possible two nearest neighbor nests within 50 meters. Distances between each nest was measured with a 50 meter Leitz tape measure.

At the end of July, when adult birds were molting and goslings were several weeks old, banding was done. Two, 18ft skiffs with 30hp mariner outboard engines were used to drop people off at the beginning of a bend in the river. People dropped off would run across the bend meeting people who were dropped off on the other side of the bend. A line would be formed cutting birds off from the mainland. The slow movement of people towards the bend of the river pushed the birds in. The boats running back and forth along the river kept the birds from crossing, so eventually they were herded into a circle and kept there until nets could be set up. Nets were set up in a half clover-like shape and birds were herded into the first loop of the net. Goslings were then sorted out and put into the third loop of the net. The middle or second loop

of the nest was left for birds that had already been processed. Chairs and banding equipment were then quickly set up and birds began to be processed. Adults and goslings were sexed, weighted, measured, and banded with a color coded tarsal tag and serially numbered Fish and Wildlife Service metal bands. All information was recorded (Fig. 6).

CONCLUSION

The Tutakoke Black Brant Project has been an ongoing project since 1986. Although data and results are still in the process of being collected and analyzed substantial knowledge was gained from this experience.

I understand how important the methods are in conducting a study. Implementation of a study and data collection has to be done in ways that will not affect the information you are collecting. Elements that affect data manipulation and outcome have to be known or information gained is not applicable for study.

It is also evident that there is a great deal of knowledge to learn from the study of these birds. It is not feasible to study a population without looking at the overall life cycle and what influences it. Factors effecting nest initiation, nutrition, the number of eggs laid, survival of goslings, onset of molt, and etc., are yet to be closely examined and understood.

I am greatly appreciative to those who have allowed me to participate in this summers field research. I was able to see how studies are executed, how important information (data) gathering is, and work closely with professors and graduate students. I have gained a great deal of knowledge to add onto my classroom experiences.

ACKNOWLEDGMENTS

I would like to thank the Office of Naval Research and The National Science Foundation for allowing me to be a part of The Marine Sciences Training Program For Alaskan Native Students U.S. Navy grant N00014-91-J-1266 and The Alaska Native Marine Sciences Enhancement Program NSF/OCE 9016113. The generous support and opportunity they allow for Native students to advance in the science field is much appreciated.

I have had the opportunity to have hands on experience in assisting in a study working with live animals, collecting data in various ways, entering data in the field, and enhancing my knowledge of scientific methods. Without the help of my supporters this summers research work experience would not have been possible.

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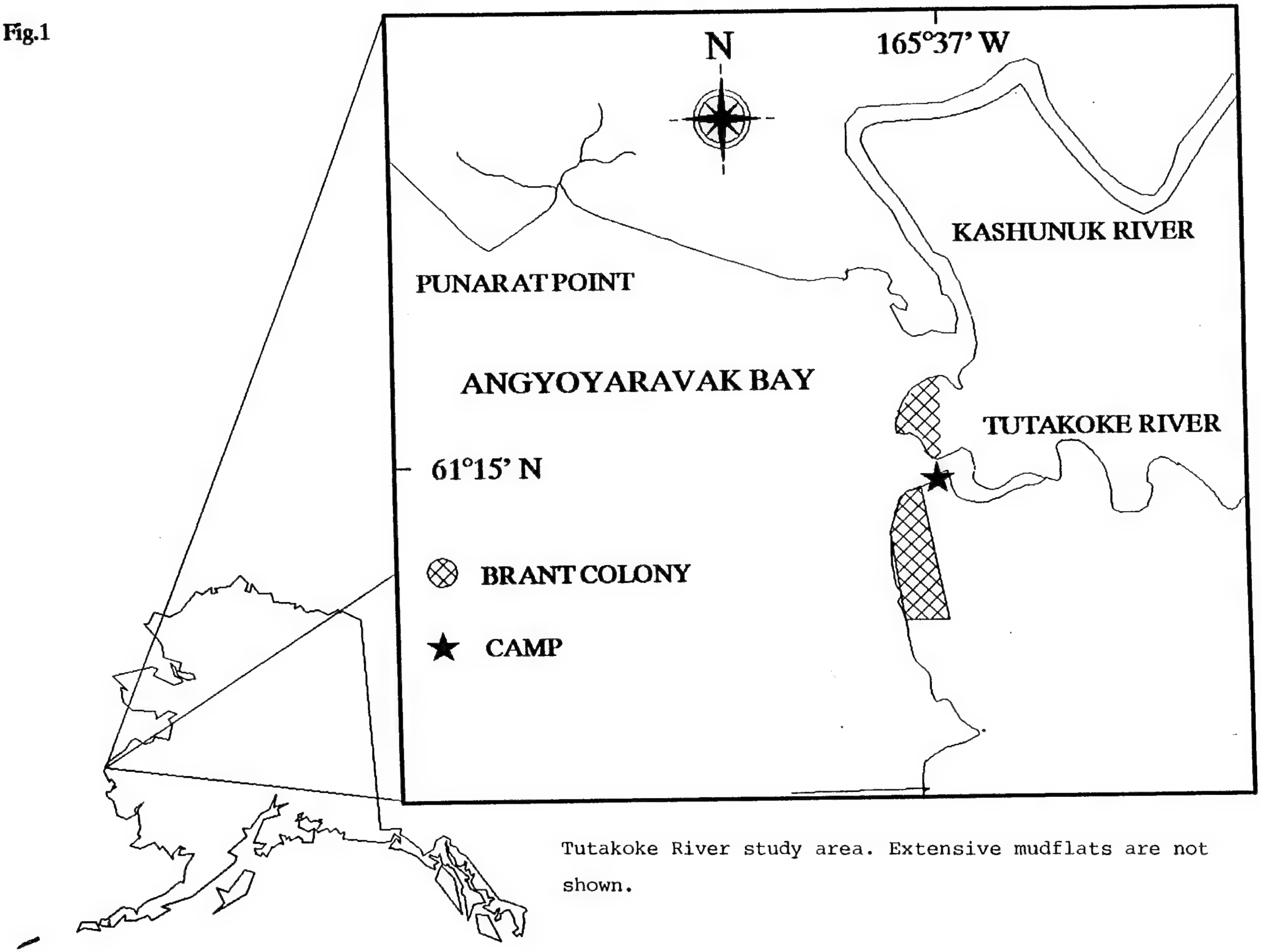
Fig.1



Tutakoke River study area. Extensive mudflats are not shown.

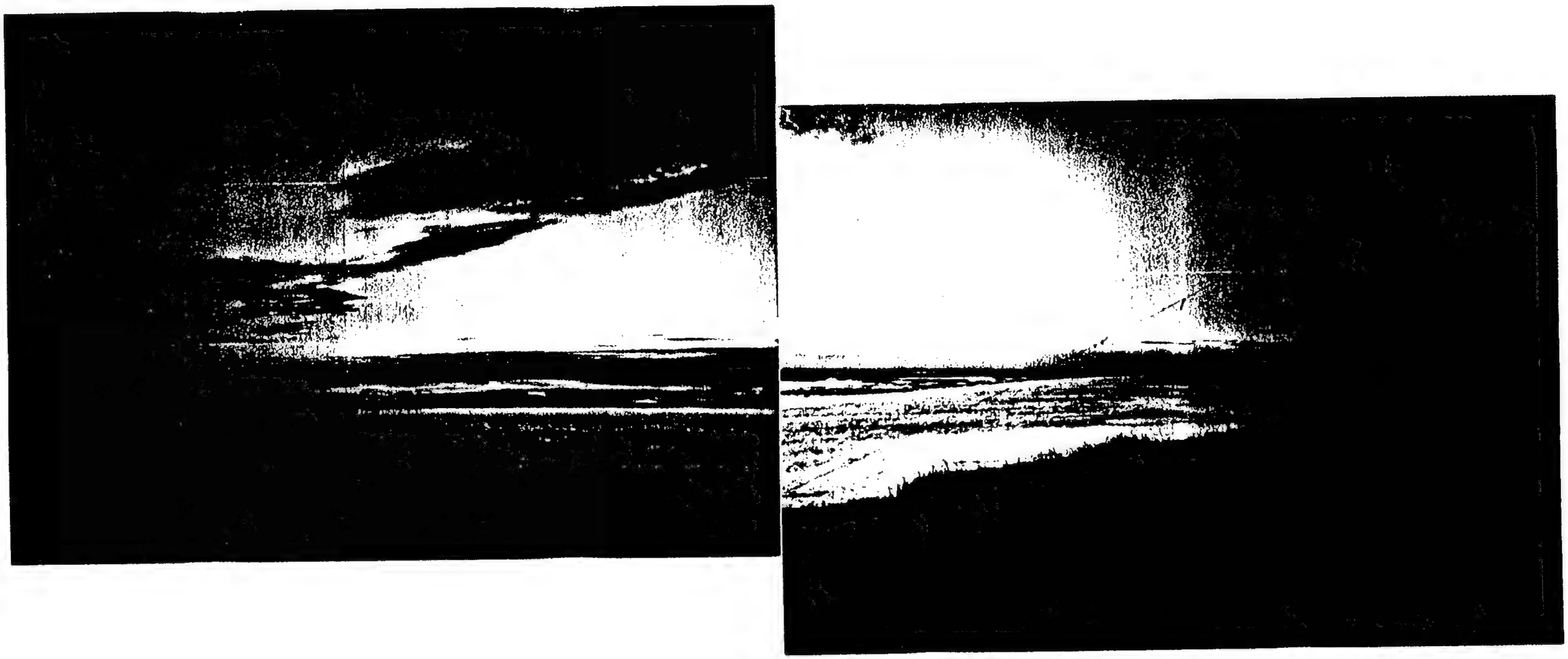


Fig. 2. Tutakoke sunset. View of study area across from camp. Area consists mostly of mudflats which are submerged by high tides.

Fig. 3. Female Black Brant protecting nest. Stick off to the left is the marker used to locate and identify nests. In the background are nesting pairs. Nesting is very dense. It was hard to move around in some areas.

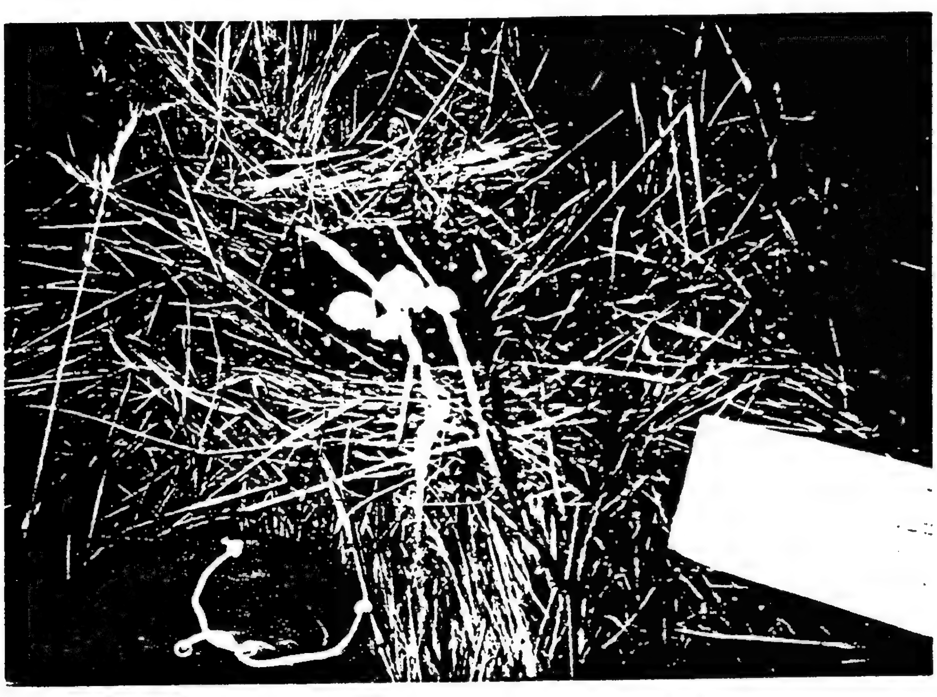


Fig. 4. Close up of Brant nest. Eggs are marked with nest number and series in which they were laid. All information was recorded in notebook.

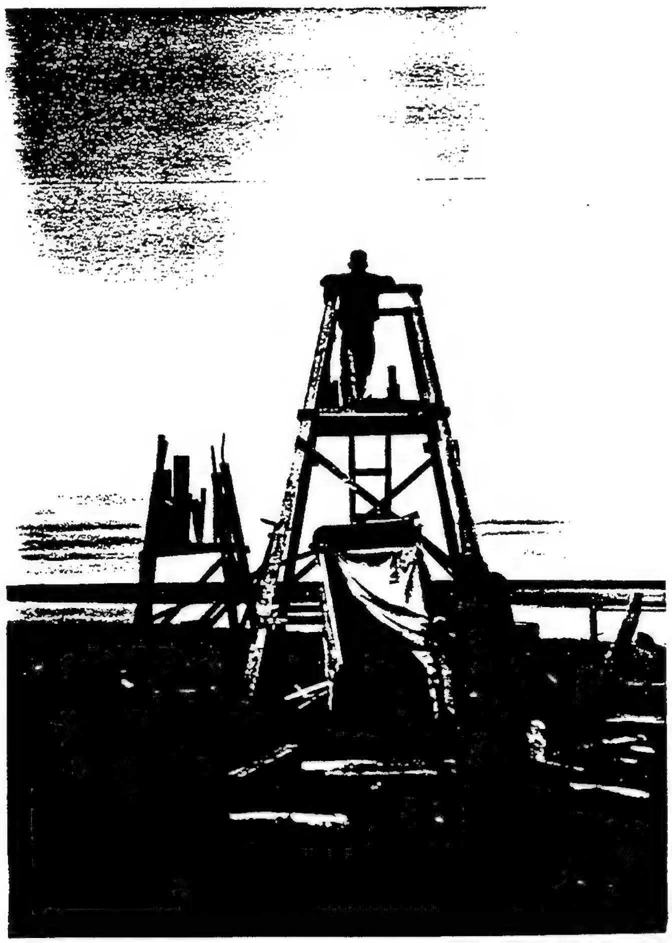


Fig. 5. Examples of towers which were used to observe birds. Blinds which were used are not present.

Fig. 6. Banding. After goslings are a couple weeks old and adults are in molt. Birds are brought from enclosed pen to bander who takes measurements. Recorder sits across from bander and records all information.

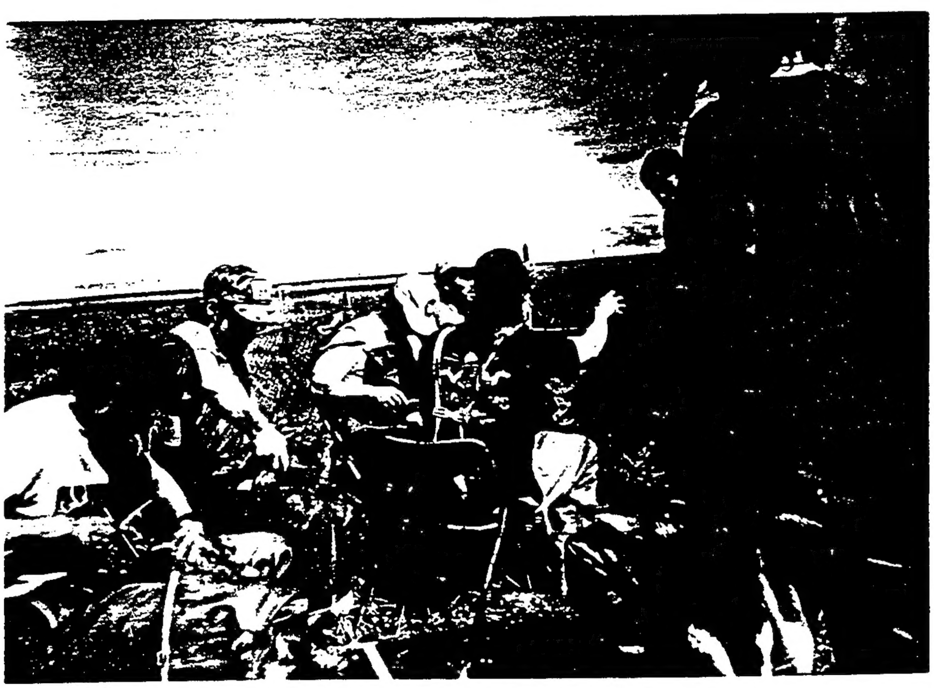


Fig. 6A.

Fig. 7. After banding all nest markers were collected from study area. Gosling in back of hood was abandoned. It was released in hopes of being adopted by a group of adults nearby.

APPENDIX 4

Report Distribution

Report Distribution

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